

PERMIT APPLICATION FOR ALTERNATIVE FUELS

Submitted to the South Dakota Department of Environment and Natural Resources

GCC Dacotah, Inc. > Rapid City Cement Plant



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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY	1
2. FACILITY OVERVIEW	2
2.1.1. Kiln Feed Preparation	2
2.1.2. Clinker Production	
2.1.3. Finished Cement Grinding	
3. PROJECT DESCRIPTION	4
3.1. Proposed Alternative Fuels	4
4. NON-WASTE FUEL DETERMINATION FOR PROPOSED ALTERNATIVE FUELS	8
5. EMISSION CHANGES	22
5.1. Oxides of Nitrogen (NO _x)	22
5.2. Carbon Monoxide (CO)	22
5.3. Sulfur Dioxide (SO ₂)	23
5.4. Organics and Organic HAPs	23
5.5. Particulate Matter (PM) and PM HAPs	24
5.6. Hydrochloric Acid (HCl) and Mercury (Hg)	24
5.7. Dioxin and Furans (D/F)	
6. EMISSION CALCULATIONS	27
6.1. Emission Calculations for CO	
6.1.1. Baseline Actual Emissions (BAE)	
6.1.2. Projected Actual Emissions (PAE)	
6.1.3. Could Have Accomodated (CHA)	
6.1.4. Emission Increases	30
7. REGULATORY APPLICABILITY	32
7.1. National Emission Standards for Hazardous Air Pollutants (NESHAP)	
7.2. New Source Performance Standards (NSPS)	
7.3. State regulatory requirements	35
8. PROPOSED ALTERNATIVE FUEL PERMIT CONDITION	41
APPENDIX A: FORMS AND FEES	42
APPENDIX B: 05/08/2013 EPA RESPONSE TO VEXOR TECHNOLOGY REGARDING ENGINEE	
FROM INDUSTRIAL SOURCES	43
APPENDIX C: PROJECTED ACTUAL AND BASELINE ACTUAL EMISSION CALCULATIONS	44
APPENDIX D. SELE-CERTIFICATION DETAILS FOR SELECTED FILE S	45

			FIGURES
	******	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Figure 2-A. Area Map of GCC Dacotah Facility in Rapid City, SD	.,,,,,,	*******	3

LIST OF TABLES

Table 2.4 December 1.4 Person Commence	4
Table 3-1. Proposed Alternative Fuels Summary	4
Table 3-2. Proposed Alternative Fuels by Category	6
Table 4-1. On-Specification Thresholds for Used Oil (40 CFR 279).	9
Table 4-2. NHSM Criteria Evaluation	14
Table 4-3. Alternative Fuels Legitimacy Criteria Comparison	15
Table 5-1. Current and Future PAE Levels and Applicable MACT Limits	25
Table 5-2. Current Short-Term Limits	26
Table 6-1. NSR Regulated Pollutants and PSD SERs	31
Table 7-1: Complete Application Requirements	38

GCC Dacotah, Inc. (GCC) owns and operates the Portland cement manufacturing plant located at 501 North Saint Onge Street, Rapid City, South Dakota 57702 (the "Facility") in Pennington County, South Dakota (SD). The Facility is classified under Standard Industrial Classification (SIC) code 3241 (Portland Cement Manufacturing).

Pennington County, South Dakota, is currently classified as attainment/unclassified for all criteria pollutants and averaging periods.¹ Under Clean Air Act (CAA) and South Dakota statute, the Facility is classified as an existing major source with respect to Prevention of Significant Deterioration (PSD) and Title V permitting requirements. The Facility operates under the Title V Air Quality Operating Permit No. 28.1121-02 issued by the South Dakota Department of Environment and Natural Resources (DENR) on December 1, 2008 and most recently updated on April 2019. The Facility is also a major source of Hazardous Air Pollutants (HAPs) and is subject to the requirements of 40 Code of Federal Regulations (CFR) Part 63 – Maximum Achievable Control Technology (MACT) Subpart LLL for the Portland Cement Manufacturing Industry. The Facility is also subject to several New Source Performance Standards (NSPS) under 40 CFR Part 60.

The Facility operates a pyroprocessing kiln system consists of 2, 4 stage preheaters precalciner and a rotary kiln. The current Title V permit, dated August 11, 2016, authorizes utilization of coal, petroleum coke, onspecification used oil, and natural gas as fuel in the kiln. With this permit application, GCC is requesting an authorization to use additional alternative fuels (AFs) in the cement kiln (Unit #9 - Rotary Kiln #6) to supplement currently permitted fuels.

As discussed in this application, Portland cement kilns are particularly well suited for the safe and efficient combustion of a wide variety of AFs. This AF project will not increase clinker production at the Facility. Furthermore, as discussed in this permit application, the properties of the proposed AFs are comparable to the current fuels utilized in the kiln system; therefore, there will be no emissions changes as a result of this AF project except for carbon monoxide (CO) which will have an increase below the PSD Significant Emission Rate (SER). CO is a combustion driven pollutant, so GCC expects that with additional AFs, CO emission levels will experience a small increase from current levels. Due to CO increases being minimal, this AF project is not considered as a major modification to an existing major source; therefore, it is exempt from PSD requirements per DENR Applicable Rules of South Dakota (ARSD) 74:36:09.

The proposed AFs are not considered solid or hazardous waste because they meet the criteria for non-hazardous secondary materials (NHSM) under the provisions of 40 CFR Part 241 Subpart B (NHSM Rule). As a result, the kiln at the Facility will continue to <u>not be</u> subject to the standards for commercial and industrial solid waste incineration (CISWI) units under 40 CFR Part 60 Subpart CCCC. Section 4 details the NHSM determinations made for the proposed additional AFs along with additional supporting data provided in Table 4-3.

GCC held a pre-application meeting with the SD DENR on August 16, 2017. With this application, GCC is requesting approval from the DENR for the proposed AF project under ARSD 74:36:05. GCC is paying necessary fees according to the schedule as defined by ARSD 74:37. GCC has provided the necessary application forms in Appendix A. Please note that the initial permit application was submitted to the DENR on February 12, 2018. This updated application includes comments provided by the DENR.

¹ EPA Green Book - https://www.epa.gov/green-book. Per §40 CFR 81.306. Accessed November 2017.

The facility is located in Rapid City, South Dakota, within the county of Pennington. An area map consisting of the plant property line overlaid upon the most recent United States Geological Survey (USGS) 7.5-minute series topographical maps of the area (1:24,000 scale) is provided in Figure 2-A. The area map shows terrain contours and the facility property relative to predominant geographical features such as highways, roads, and streams, as well as significant landmarks.

The manufacturing process at the facility can be divided into three main steps: kiln feed preparation, clinker production, and finished cement grinding.

2.1.1. KILN FEED PREPARATION

The basic ingredients of cement include oxides of calcium, silicon, aluminum, and iron. The Facility uses limestone as a calcium source (CaO). The limestone, silica source, and aluminum source used for the manufacturing process are typically mined from quarries owned by GCC. The iron source is typically purchased and transported to the Facility by either truck or rail car. Operations at the quarry involve topsoil removal, drilling, blasting, and hauling of blasted material. The blasted material, or raw material, is delivered to a crusher, which breaks material down into smaller sizes. After crushing, raw materials are stored and transported to raw mills, which are used to grind the crushed materials into appropriate sizes. The ground raw material is collected and fed to a blending system to provide the kiln with homogenous raw feed. Fuel (coal and petroleum coke) for the kiln system is purchased and transported by either truck or rail car. Natural gas is used for start-up, and as needed for supplemental heat when coal is wet or coal mill is down. On-site used oil is also used as a fuel. Solid fuels are stored in storage bins and subsequently pneumatically conveyed to coal mills. Fuel is processed (pulverized) in coal mills, then conveyed and stored prior to firing in the process.

2.1.2. CLINKER PRODUCTION

The clinker production process involves high temperature processing of raw materials in a rotary kiln. Several different chemical reactions necessary to produce Portland cement take place within the kiln. The kiln is a countercurrent heating device, which is configured so that the material fed into the cooler upper section is gravity fed to the hotter discharge section prior to being discharged to a clinker cooler. Burners at the discharge section of the kiln produce hot gases to heat materials and drive the clinkering reactions. The cement clinker formation process in the kiln consists of five stages, which occur at an increasing temperature of the raw materials. In the preheater, uncombined water evaporates from raw materials as the temperature increases to 100 °C. Calcination occurs between 800 °C and 1,100 °C, which liberates carbon dioxide (CO₂) from the carbonate component. Sintering of oxides occurs in the burning zone of the kiln at temperatures up to 1,510 °C. The sintering (or clinkering) reactions chemically combine calcined material with silica, alumina, and iron to form tricalcium silicate (Ca₃SiO₅), dicalcium silicate (2CaOSiO₂), tricalcium aluminate (3CaOAl₂O₃), and tetracalcium alumino-ferrite (Ca₄AlFeO₇). Clinker is quick-cooled following the sintering reactions in the clinker cooler, as the material heat is recovered and re-used in the process.

2.1.3. FINISHED CEMENT GRINDING

Cooled clinker is conveyed to intermediate storage then fed to the finishing mills, where it is combined with gypsum, limestone, and other additive materials. The clinker, gypsum, limestone, and other additives are

ground into a fine, homogenous powder in the finishing mills to form Portland cement. The finished product is transferred to the cement storage silos prior to shipment off site by either truck or railcar.

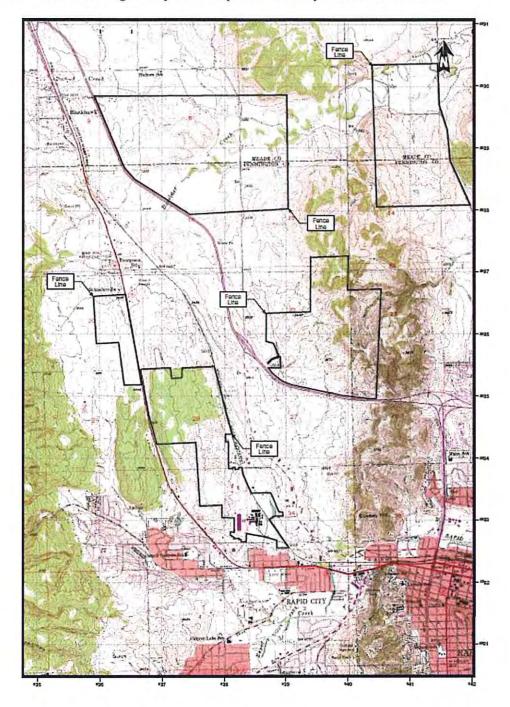


Figure 2-A. Area Map of GCC Dacotah Facility in Rapid City, SD

The following section provides description of the AFs that will be used at the Facility as part of the proposed project ("AF project"). The primary fuel fired in the kiln and precalciner is pulverized coal. Additionally, onspecification used oil, petroleum coke, and natural gas are also utilized in the kiln. GCC is already permitted to use all three type of fuels: solid (coal and coke), liquid (on-spec used oil), and gas (natural gas).

With this proposed AF project, GCC proposes to use additional AFs as a supplementary fuel to coal, used oil, petroleum coke, and natural gas. These fuel-related changes will not increase clinker or upstream limestone or downstream cement production at the Facility. Proposed AFs will replace a portion of current fuel mix. Utilization of the proposed additional AFs will also not require a physical change to the kiln system. The facility will continue to comply with kiln emission limits using existing emission controls and work practices, and continue to demonstrate compliance using continuous emission monitoring systems (CEMS) and other methods.

3.1. PROPOSED ALTERNATIVE FUELS

This AF project aligns with an industry-wide movement towards the use of waste AFs in cement kilns, which has been supported by a variety of sectors, ranging from the U.S. EPA to manufacturers. According to the Portland Cement Association's (PCA's) 2008 annual report, over 60% of U.S. and Canadian cement plants reporting used one or more waste fuels in 2008, compared to zero waste fuel utilization in 1972. The energy from waste fuels now account for over 10% of the energy demand at cement plants.² The U.S. EPA and other environmental institutions have also thoroughly researched the use of AFs in cement kilns in recent years.^{3,4}

With this AF project, GCC would like to request an authorization to use additional AFs in the kiln system at the Facility. Table 3-1 presents a summary of the proposed AFs.

Table 3-1. Proposed Alternative Fuels Summary

Proposed Alternative Fuels	
Asphalt Including Asphalt Shingles	
Biodiesel Filter (BDFs) cakes	
Biosolids sludge	
Construction and Demolition (C&D) materials	
Construction and Demolition (C&D) wood	
Creosote-treated railroad ties and Other Treated Railroad Ties	
Currency paper	
Fuel oil and liquid fuel	
Furniture fiber, such as carpet and mattresses	
Industrial debris, such as paper, cardboard, fibers, and plastics	
Mixed paper	
Mixed plastics	
Oily solids, such as absorbents, rags, grease, wax and other similar materials	
Oil filter fluff	

² PCA. 2008. U.S. and Canadian Portland Cement Industry: Plant Information Summary,

³ EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."

⁴ The Pembina Institute and Environmental Defence. 2014. White Paper on Alternative Fuel Use in Cement Manufacturing.

Proposed Alternative Fuels							
Oil/water emulsions							
Paper and plastics							
Petroleum materials							
Print toner and associated manufacturing byproducts							
Pulp/paper sludge							
Refuse Derived Fuels (RDFs)/Engineered fuels							
Rubber products							
Tire Derived Fuel (TDF) including whole tires, shredded tires, and tire fluff							
Used oils							
Vehicle fluff/Automobile Shredder Residue (ASR)							
Wind turbine blades, shredded							
Wood chips, wood scrap, and forest products							
Woody fiber							

As explained in further detail in Section 4, the AFs listed above to be used at the Facility can be characterized as NHSMs under the provisions of 40 CFR 241 Subpart B, Identification of Non-Hazardous Secondary Materials that are Solid Wastes When Used as Fuels or Ingredients in Combustion Units (NHSM Rule).

The proposed AFs are either "traditional fuels," as defined in 40 CFR 241.2 and are therefore "not secondary materials or solid wastes unless discarded," or the AFs meet NHSM criteria, as required by 40 CFR 241.3(b)(4):

[The following non-hazardous secondary materials are not solid wostes when combusted...] Fuel or ingredient products that are used in a combustion unit, and are produced from the processing of discarded non-hazardous secondary materials and that meet the legitimacy criteria specified in paragraph (d)(1) of this section, with respect to fuels, and paragraph (d)(2) of this section, with respect to ingredients.

There are three "categories" that AFs for combustion units fall under, based on the structure of the NHSM Rule.

- 1. First, as defined above, traditional fuels, such as fuel oil, are inherently not considered secondary materials or solid waste if they have not been discarded. Therefore, no additional analysis is needed to show that fuels in this category ("Category 1") meet NHSM criteria.
- 2. Second, 40 CFR 241.4(a)(1) (7) list several specific fuels that are categorically considered to meet NHSM criteria without requiring additional approval. These fuels are also subject to the requirements described in 40 CFR 241.3(b)(4). No additional analysis is needed to show that fuels in this category ("Category 2") meet NHSM criteria, provided that they meet the requirements in the aforementioned 40 CFR 241.3(b)(4).

Any AF that does not fall into either of the first two categories would then be required to be "processed" sufficiently and meet the following "legitimacy criteria" set forth in 40 CFR 241.3(d)(1) to receive an NHSM determination:

- > The materials must be managed as a valuable commodity.
- > The material must have meaningful heating value of no less than 5,000 British thermal units per pound (BTU/lb).
- > The material will contain contaminants at levels comparable in concentration to or lower than those in traditional fuels which the kiln or precalciner is designed to burn.

Of these fuels, they can be split into "Category 3" and "Category 4" based on if GCC is including details on self-certification on processing and legitimacy criteria for certain fuels in this application and remaining fuels which still require GCC to petition U.S. EPA and obtain approval under 40 CFR § 241.3(a) or GCC to receive U.S. EPA's concurrence on a self-certification.

- 3. In this application, Category 3 refers to proposed AFs for which GCC is providing self-certification details on processing steps and legitimacy criteria as a part of this application. Since all the necessary details are included in this application, these AFs do not require U.S. EPA approval on the self-certification process. Self-certification steps for these AFs are included in Appendix D. These AFs are:
 - a. Furniture fiber
 - b. Mixed plastics
 - c. Vehicle fluff/ASR
 - d. Woody fiber
 - e. Wind turbine blades
- 4. Category 4 refers to proposed AFs that still require GCC to either file a petition or obtain U.S. EPA's concurrence for these fuels as NHSM.

Table 3-2 reiterates the AFs that GCC proposes to use in the Facility's cement kiln, sorted by these four categories.

Table 3-2. Proposed Alternative Fuels by Category

	Proposed Alternative Fuels by Category
Category 1: Ti	raditional Fuels
Fuel oil and liq	uid fuel
Asphalt includ	ing Shingles
Used oils	
Wood chips, w	ood scrap, and forest products
Category 2: Ca	ategorical Exemptions
Tire Derived F	uel (TDF) including whole tires, shredded tires, and tire fluff
Construction a	nd Demolition (C&D) wood
Creosote-treat	ed railroad ties and Other Treated Railroad Ties
	HSM AFs That are Sufficiently Processed and Meet Legitimacy Criteria, and ing Self-Certification Details
Mixed plastics	
	; such as carpet and mattresses
Vehicle fluff/A	utomobile Shredder Residue (ASR)
Wind turbine b	olades, shredded
Woody fiber	
	HSM AFs That are Sufficiently Processed and Meet Legitimacy Criteria and file a petition or obtain U.S. EPA's approval on self-certification process
Biodiesel Filter	r (BDFs) cakes
	nd Demolition (C&D) materials
Biosolids sludg	ge
Currency pape	
Industrial debi	ris, such as paper, cardboard, fibers, and plastics
Mixed paper	

Proposed Alternative Fuels by Category							
Oily solids, such as absorbents, rags, grease, wax and other similar materials							
Oil/water emulsions							
Oil filter fluff							
Paper and plastics							
Petroleum materials							
Print toner and associated manufacturing byproducts							
Pulp/paper sludge							
Rubber products							
Refuse Derived Fuels (RDFs)/Engineered fuels							

If a cement kiln were to burn hazardous waste, it would be subject to MACT Subpart EEE instead of Subpart LLL. However, as the proposed usage of additional AFs would be considered a non-waste fuel rather than a solid waste under the final NHSM rule, the Facility will continue to be a major source of HAPs subject to the MACT Subpart LLL requirements for Portland cement manufacturing.

The combustion of these non-waste fuels is expected to result in the following benefits:

- > Reduction of CO₂ emissions and insignificant or no changes in all other pollutants⁵;
- > Reduction in materials currently sent to landfills; and
- > Reduction in the consumption of natural resources and fossil fuels (i.e., coal, natural gas).

⁵ In the U.S. EPA sector report titled, "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials," U.S. EPA also indicates that the use of AFs results in reduced emissions of greenhouse gases.

4. NON-WASTE FUEL DETERMINATION FOR PROPOSED ALTERNATIVE FUELS

This section provides a non-waste fuel determination for the AFs proposed to be used at the Facility. This determination follows the procedures stipulated under 40 CFR Part 241, Solid Wastes Used as Fuels or Ingredients in Combustion Units. More specifically, this section provides a characterization of the AFs as a NHSM evaluated under the provisions of 40 CFR 241 Subpart B, Identification of Non-Hazardous Secondary Materials that are Solid Wastes When Used as Fuels or Ingredients in Combustion Units. As demonstrated below, GGC's proposed AFs are considered a non-waste fuel under the NHSM Rule.

Overview

In order to verify that the AFs are not considered a "solid waste" as defined under 40 CFR 241, GCC must demonstrate that the AFs meets certain criteria under the NHSM Rule. By definition, traditional fuels are not considered secondary materials or solid wastes unless discarded. Per 40 CFR 241.2, traditional fuels are defined as:

Materials that are produced as fuels and are unused products that have not been discarded and therefore, are not solid wastes, including: (1) Fuels that have been historically managed as valuable fuel products rather than being managed as waste materials, including fossil fuels (e.g., coal, oil and natural gas), their derivatives (e.g., petroleum coke, bituminous coke, coal tar oil, refinery gas, synthetic fuel, heavy recycle, asphalts, blast furnace gas, recovered gaseous butane, and coke oven gas) and cellulosic biomass (virgin wood); and (2) alternative fuels developed from virgin materials that can now be used as fuel products, including used oil which meets the specifications outlined in 40 CFR 279.11, currently mined coal refuse that previously had not been usable as coal, and clean cellulosic biomass. These fuels are not secondary materials or solid wastes unless discarded.

For fuels that meet this definition, no further analysis is required. The evaluation of AFs that fall under what is defined as traditional fuels is provided below.

The NHSM Rule also includes certain categorical exemptions for NHSMs under 40 CFR 241.4(a); an NHSM under any of these categories is not considered to be a solid waste, but rather a non-waste fuel, and no further analysis is required. The evaluation of potentially applicable exemptions is provided below.

For NHSMs that do not fall under any categorical exemptions, the NHSM Rule states that a fuel which is produced from the "sufficient processing" of discarded NHSMs and which meets the "legitimacy criteria" of 40 CFR 241.3(d)(1) is not considered to be a solid waste, but rather a non-waste fuel. Therefore, in order for the AFs to be classified as a non-waste fuel, the AFs must be produced in a manner which constitutes "sufficient processing" under the NHSM Rule and which demonstrates that the "legitimacy criteria" are met. The evaluation of these criteria is provided below. Several AFs, but not all, that do not fall under any categorical exemptions have received non-waste determinations from EPA via comfort letters. Therefore some AFs proposed by GCC for this AF project have not been previously approved by EPA and do not fall under any categorical exemption.

See Table 3-2 from the prior section for a summary table, which categorizes GGC's proposed AFs into these four categories.

Evaluation of Traditional Fuels (Category 1 Fuels)

GCC may categorize certain proposed AFs as traditional fuels which is defined under 40 CFR 241.2 and are not treated as a solid waste. Proposed AFs that meet the definition are: (1) fuel oil and liquid fuel, (2) asphalt, (3) used oils, and (4) wood chips, wood scrap, and forest products. Fuel oil, liquid fuel, and asphalt are covered under the first part of the definition and are fuels managed as a fuel product including fossil fuels and their derivatives. Used oils, wood chips, wood scrap, and forest products are covered under the second part of the definition and are alternative fuels developed from virgin materials that can now be used as fuel products.

As a coal derivative, asphalt is considered a traditional fuel. GCC will use asphalt from a variety of sources, including asphalt shingles.

Additionally, GCC will document when any used oil utilized for this AF project meets the specifications outlined in 40 CFR 279.11. Only used oil that does not exceed the allowable limits shown below in Table 4-1 are subject to 40 CFR 279 when burned for energy recovery, and are considered a traditional, or Category 1, fuel per the definition in 40 CFR 241.2. When used oil is not on-specification, meaning it exceeds the thresholds in Table 4-1, that oil would not be a traditional fuel and would instead be subject to the same criteria and Category 3 and Category 4 fuels are subject, as described later in this section.

Constituent/property	Allowable Level
Arsenic	5 ppm maximum
Cadmium	2 ppm maximum
Chromium	10 ppm maximum
Lead	100 ppm maximum
Flash Point	100 degrees F minimum
Total Halogens	4,000 ppm maximum

Table 4-1. On-Specification Thresholds for Used Oil (40 CFR 279).

If the used oil exceeds any these allowable limits, it is then subject to 40 CFR 279.60. GCC will comply with all applicable regulations in regards to used oil. The use of non-hazardous used oils as an AF in cement kilns is well established, with 16% of cement plants reporting using used oil as an AF in 2006.6

Evaluation of Specific Non-Waste Determinations under 40 CFR 241.4(a) (Category 2 Fuels)

To determine whether the AFs are a solid waste or a non-waste fuel, GCC may also assess whether any of the AFs falls under any of the categories previously approved by U.S. EPA to be non-waste fuels (i.e., those fuels listed under 40 CFR 241.4(a)).⁷ Of the proposed fuels, scrap tires, C&D wood, and railroad ties fall under this category pursuant to 40 CFR 241.4(a)(1), 40 CFR 241.4(a)(5), and 40 CFR 241.4(a)(7), respectively.

40 CFR 241.4(a)(1) stipulates that scrap tires that (1) are managed under the oversight of established collection programs and (2) are not discarded are non-waste fuels when used as fuel in a combustion unit, such as the kiln

⁶ EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."

Note that the February 7, 2013 revision to the NHSM Rule included codified determinations that certain NHSMs are non-wastes when used as fuels. NHSMs that are considered on the categorical list of non-waste fuels do not need to be shown to meet the legitimacy criteria that determines whether the NHSM is a non-waste on a site-by-site basis (78 FR 9137).

at the Facility. GCC will receive tires from an established tire management program to ensure the scrap tires are not discarded (i.e., are recycled) and are handled as valuable commodities (i.e., are tracked thoroughly by manifests). Scrap tires are not seen as waste, but have specifications for tracking and safe delivery to the end use markets.⁸ As such, the scrap tires are managed under the oversight of an established collection program and may be considered a non-waste fuel when used as fuel in a combustion unit per 40 CFR 241.4(a)(1). In addition, Tire fluff is a non-hazardous secondary material that is not a solid waste when used as a fuel in a combustion unit because it is derived from scrap tires that are not discarded and are managed under the oversight of established tire collection programs, including tires removed from vehicles and off-specification tires. In summary, tire fluff originates from the processing of these tires and, as such, is still be considered "scrap tires" or derived from scrap tires within the context of the rule; thus is interpreted as a categorical non-waste fuel.

40 CFR 241.4(a)(5) stipulates that C&D wood processed from C&D material according to best management practices, described as sorting by operators that excludes or removes various materials, are not solid wastes when used as a fuel in a combustion unit. In accordance with the rule, GCC will obtain a written certification from C&D processing facilities that the C&D wood has been processed by trained operators in accordance with best management practices specified in the rule.

40 CFR 241.4(a)(7) stipulates creosote-treated railroad ties (CTRTs) that are processed and then combusted in units designed to burn both biomass and fuel oil as part of normal operations "are not solid wastes when used as a fuel in a combustion unit." Processing must include, at a minimum, metal removal and shredding or grinding. Similarly, 40 CFR 241.4(a)(8) stipulates Creosote-borate treated railroad ties, and mixtures of creosote, borate and/or copper naphthenate treated railroad ties that are processed and then combusted in the certain types of units. Similarly, 40 CFR 241.4(a)(9) and (a)(10) stipulate copper naphthenate treated railroad ties and copper naphthenate-borate treated railroad ties to be combusted in certain units as long as that are processed and then combusted in units designed to burn biomass, biomass and fuel oil, or biomass and coal. Processing must include at a minimum, metal removal, and shredding or grinding. According to GCC's supplier, the railroad ties will be creosote-treated and GCC will ensure sufficient processing is performed, such as inspecting the ties prior to shredding to manually remove any materials that are not CTRTs, removal of metal with the use of a magnet, and shredding and sizing the CTRTs and OTRTs.

Evaluation of Non-Specific Non-Waste Determinations under 40 CFR 241.3 (Category 3 and Category 4 Fuels)

For GCC's remaining proposed AFs that are not traditional fuels and do not fall under any categorical exemptions, they will be categorized as non-waste pursuant to the qualifications under 40 CFR 241.3 (b). GCC will need to determine whether the AFs are included in any of the following categories from 40 CFR 241.3(b):

- Material used as a fuel that remains within the control of the generator;
- Material that has not been discarded;
- > Material used as an ingredient; or
- Fuel used in a combustion unit that is produced from the processing of discarded NHSMs.

If the AFs are determined to be included in one of the categories above, then GCC will ensure the AFs meet the all of the "legitimacy criteria" under 40 CFR 241.3(d). For fuel produced from the processing of discarded NHSMs, the following legitimacy criteria under 40 CFR 241.3(d)(1) will be evaluated:

Managed as a valuable commodity such that the storage of the NHSM does not exceed reasonable time

⁸ This aligns with guidance for what would constitute an established tire collection program under 76 FR 15492.

- frames, and releases to the environment are prevented;
- > Meaningful heating value (typically around 5,000 Btu/lb or greater) and used as a fuel in a combustion unit that recovers energy; and
- > Contains contaminants or groups of contaminants at levels comparable in concentration or lower than those in traditional fuels which the combustion unit is designed to burn.

If the AFs fall into one of the aforementioned categories and also satisfy the applicable legitimacy criteria, then the AFs are not considered to be a solid waste when combusted. If a NHSM is not included in the categories of 40 CFR 241.3(b) and does not qualify for a categorical non-waste determination under 40 CFR 241.4(a), then the NHSM is considered a solid waste when combusted.⁹ Any NHSM that is included in the categories of 40 CFR 241.3(b) but does not meet the applicable legitimacy criteria under 40 CFR 241.3(d) is also considered to be a solid waste when combusted.

Evaluation of the "Processing" Criterion under 40 CFR 241.3(b)(4)

40 CFR 241.3(b) describes how to treat waste which is used to derive fuel. Specifically, 40 CFR 241.3(b)(4) reads as follows:

Fuel or ingredient products that are used in a combustion unit, and are produced from the **processing** of discarded non-hazardous secondary materials and that meet the legitimacy criteria specified in paragraph (d)(1) of this section, with respect to fuels, The legitimacy criteria apply after the non-hazardous secondary material is processed to produce a fuel or ingredient product. Until the discarded non-hazardous secondary material is processed to produce a non-waste fuel or ingredient, the discarded non-hazardous secondary material is considered a solid waste and would be subject to all appropriate federal, state, and local requirements.

In order for AFs to be included in the category above, the Facility must adequately "process" discarded NHSMs. The definition of "processing" is critical to this determination and is provided below, as defined at 40 CFR 241.2:

Processing means any operations that transform discarded non-hazardous secondary material into a non-waste fuel Processing includes, but is not limited to, operations necessary to: Remove or destroy contaminants; significantly improve the fuel characteristics of the material, e.g., sizing or drying the material in combination with other operations; chemically improve the as-fired energy content; or improve the ingredient characteristics. Minimal operations that result only in modifying the size of the material by shredding do not constitute processing for purposes of this definition.

GCC proposes to receive the AFs listed in Table 3-1 for use in the Facility's kiln system. Upon receiving the AFs, GCC will ensure they are sufficiently processed either off-site at the originator, stores, distributors by a third party, or as necessary on-site by GCC. Processing AFs will be conducted as necessary to maintain product quality, improve comhustion characteristics, or remove contaminants, to ensure stable combustion conditions are maintained in the kiln when utilizing AFs. Processing may include, but are not limited to, the following as is necessary:

- Inspect and remove debris
- > Physical removal of contaminates (mechanical means to remove dirt and debris)

⁹ Note that it is possible for EPA to specifically list an NHSM as a non-waste fuel at 40 CFR Part 241.4(a) by following the petition requirements cited at 40 CFR Part 241.4(b). Additionally, a NHSM that is used as a fuel and not managed within the control of the generator may be granted a non-waste determination from EPA by following the application requirements stipulated at 40 CFR 241.3(c).

- > Removal of loose scrap metal
- > Inspection and removal based on size
- Reject AFs and/or loads, as necessary
- Removal of heavy debris through pressure washing or mechanical means

The removal of inert materials and metals constitutes the removal of contaminants as well as improvement of fuel characteristics by removing material with low energy content. Further, the drying of the material and the sizing-down of the larger AFs represent a significant improvement of fuel characteristics. Lastly, per several comfort letters released by U.S. EPA concerning the NHSM rule, U.S. EPA regularly considers that a combination of contaminant removal and shredding/sizing, in a way that has tangible improvement on fuel characteristics, meets the definition of "sufficient processing." Therefore, the AFs will be produced in a manner which constitutes the "processing" of discarded NHSM under 40 CFR 241.3(b)(4).

Evaluation of the Legitimacy Criteria under 40 CFR 241.3(d)(1)

In order for the AFs to be classified as a non-waste fuel, it must also satisfy all legitimacy criteria under 40 CFR 241.3(d) (1). As stated in 40 CFR 241.3(b) (4), the legitimacy criteria apply to the NHSM after processing. Each legitimacy criterion from 40 CFR 241.3(d)(1) is shown below in **bold**, **italicized** text and an explanation regarding how the AFs meet that criterion is shown in standard text:

- (i) The non-hazardous secondary material must be managed as a valuable commodity based on the following factors:
 - (A) The storage of the non-hazardous secondary material prior to use must not exceed reasonable time frames;

It is expected that the AFs will meet this criterion. GCC will use the AFs in a combustion unit within a reasonable time period, comparable to that of traditional fuels used at the Facility.¹¹

(B) Where there is an analogous fuel, the non-hazardous secondary material must be managed in a manner consistent with the analogous fuel or otherwise be adequately contained to prevent releases to the environment;

It is expected that the AFs will meet this criterion. Coal/gas/used oil are considered to be the analogous fuels. The AFs will be stored and combusted in a manner similar to that of coal/coke/gas/used oil.

(C) If there is no analogous fuel, the non-hazardous secondary material must be adequately contained so as to prevent releases to the environment;

Coal/coke/gas/used oil is the analogous fuel, so this criterion is not applicable.

(ii) The non-hazardous secondary material must have a meaningful heating value and be used as a fuel in a combustion unit that recovers energy.

The AFs meets this criterion. Typically, a meaningful high heating value (HHV) is regarded as

¹⁰ EPA Response Letter 06/03/2011. WASTE DETERMINIATION FOR OIL FILTER FLUFF THAT IS BURNED IN COMBUSTION UNITS.

¹¹ Per 76 FR 15520, a "reasonable time frame" is not explicitly defined as a specific, finite period of time. Instead, EPA has stated that a reasonable time frame shall constitute that which is cost effective. EPA expects that an entity will document and keep records of the "reasonable time frame" selected and the basis for that time frame.

¹² Per 76 FR 15520, an "analogous fuel" is a traditional fuel for which the NHSM substitutes, and which serves the same function and has similar physical and chemical properties as the NHSM.

5,000 Btu/lb or greater.¹³ The AFs are expected to have an energy content of 5,400 Btu/lb to 19,000 Btu/lb (see Table 4-3). Therefore, the AFs have a meaningful heating value.

(iii) The non-hazardous secondary material must contain contaminants or groups of contaminants at levels comparable in concentration to or lower than those in traditional fuel(s) which the combustion unit is designed to burn. In determining which traditional fuel(s) a unit is designed to burn, persons may choose a traditional fuel that can be or is burned in the particular type of boiler, whether or not the combustion unit is permitted to burn that traditional fuel. In comparing contaminants between traditional fuel(s) and a non-hazardous secondary material, persons can use data for traditional fuel contaminant levels compiled from national surveys, as well as contaminant level data from the specific traditional fuel being replaced. To account for natural variability in contaminant levels, persons can use the full range of traditional fuel contaminant levels, provided such comparisons also consider the variability in non-hazardous secondary material contaminant levels. Such comparisons are to be based on a direct comparison of the contaminant levels in both the non-hazardous secondary material and traditional fuel(s) prior to combustion.

The AFs meet this criterion. This criterion requires a comparison of the concentration of contaminants typically found in traditional fuels and the corresponding concentration of each respective contaminant present in the AFs to be used at the Facility. Contaminants of interest are the nine Clean Air Act (CAA) Section 129(a)(4) pollutants and the hazardous air pollutants (HAP) listed in CAA Section 112(b). ¹⁴ In determining which traditional fuel the unit (kiln) is designed to burn for comparing contaminants, it is assumed that the AFs will be combusted in a unit which is designed to burn coal.

Thus, the contaminant concentration ranges of the AFs are compared to those in the traditional fuel of coal. For traditional fuel data, as stated in the rule excerpt above, fuel contaminant concentrations may be compared using ranges compiled from national surveys. National survey data is available for contaminant concentrations in traditional fuels from U.S. EPA's Office of Air Quality Planning and Standards (OAQPS). GCC has compiled data on the contaminant levels of its proposed AFs through testing of fuel samples from their suppliers or through publicly available research (see Table 4-3). The AFs proposed to be used at the Facility are expected to be similar in contaminant concentrations to the AFs tested in the aforementioned references.

Using the references outlined above, we found overall that the AFs and coal have a comparable level of contaminants. As further demonstrated in Section 5 of this application, GCC expects no increase to emissions as a result of supplementing coal with AFs except for CO.

Review of Available Alternative Fuels Information

As mentioned previously, AF use in cement kilns has grown rapidly in recent decades. With this growth, the number of available "Category 3" and "Category 4" AFs has also increased, particularly waste-derived AFs. To ensure that the proposed AFs in this AF project meet NHSM criteria, GCC has researched available information about these fuels and determined that they meet all applicable criteria to be considered non-waste fuels, as indicated in Table 4-2 below.

¹³ Per 76 FR 15482, "Except as otherwise noted, to satisfy the meaningful heating value criterion, the non-hazardous secondary material must have at least 5,000 Btu/lb, as fired (accounting for moisture), since the as-fired energy content is the relevant parameter that must be assessed to determine if it is being discarded rather than used as a fuel for energy recovery." This benchmark was reinforced in the final NHSM Rule under 78 FR 9172.

¹⁴ Per 40 CFR 241.2.

Table 4-2. NHSM Criteria Evaluation

Category 3 and 4 AFs	Sufficient Processing	Managed as a Valuable Commodity	Meaningful Heating Value (> 5,000 BTU/lb)	Comparable Contaminant Levels
Category 3 (w	vith Self-Certif	ication Details	Included)	
Furniture fiber, such as carpet and mattresses	х	х	Х	х
Mixed plastics	Х	Х	X	X
Vehicle fluff/Automobile Shredder Residue (ASR)	х	х	Х	х
Wind turbine blades, shredded	Х	Х	X	X
Woody fiber	Х	Х	Х	Х
Category 4 (A	AFs still requi	ring U.S. EPA's	approval)	
Biodiesel Filter (BDFs) cakes	X	X	X	X
Biosolids sludge	X	X	X	X
Construction and Demolition (C&D) wood	Х	х	Х	Х
Construction and Demolition (C&D) materials	Х	х	Х	х
Currency paper	Х	Х	X	X
Industrial debris, such as paper, cardboard, fibers, and plastics	х	х	Х	х
Mixed paper	Х	Х	Х	Х
Oily solids, such as absorbents, rags, grease, wax and other similar materials	х	х	х	X
Oil filter fluff	Х	Х	Х	X
Oil/water emulsions	Х	Х	X	X
Paper and plastics	X	Х	Х	X
Petroleum materials	Х	X	X	X
Pulp/paper sludge	X	X	X	X
Refuse Derived Fuels (RDFs)/Engineered fuels	х	Х	X	х
Rubber products	Х	Х	Х	X

In addition, Table 4-3 shows data obtained by GCC to verify that these proposed AFs have meaningful heat values and "comparable contaminant levels" to coal. GCC has provided additional contaminant data in Appendix D as part of self-certification steps for several proposed AFs, including Furniture fiber, Mixed plastics, Vehicle fluff/ASR, and Woody fiber.

Table 4-3. Alternative Fuels Legitimacy Criteria Comparison

Parameter	Units	Coal range	Industrial	RDF	Pulp/Paper	Biodiesel	Biosolids	C&D	C&D	Rubber	Mixed	Paper &	Mixed	Currency	Vehicle	ASR	Furniture	Wind Turbine	Petroleum	Oil/Water	Grease	Oil Filter	Woody
a a a a a a a a a a a a a a a a a a a	Onics	EPA/OAQPS	Debris	KDI	Sludge	Filter Cake	Sludges	Material	Wood	Products	Plastics	Plastics	Paper	Paper	Fluff	ASIX	Fiber	Blades	Materials	Emulsions	Trap	Fluff*	Fiber
		database						#1	#2						#1	#2							
Antimony (Sb)	mg/kg	ND-10	< 5	5.519	< 5	< 5	< 5	<5	< 5.35	<5	1.81	<5	< 5	<5		0.4	20.6	< 5	<5	6.3	< 5.35		2.9
Arsenic (As)	mg/kg	ND-174	< 5	6.17	< 5	< 5	< 5	16.42	4.11	<5	1.04	<5	< 5	<5		<0.1	0.24	6.01	<5	2.6	< 2.22	0.631	6.8
Beryllium (Be)	mg/kg	ND-206	0.34	0.043	< 0.1	< 0.1	< 0.1	<0.1	< 0.09	< 0.01	0.178	<0.01	< 0.1	<0.01		0.051	0.117	0.76	< 0.01	< 0.05	< 0.09		0.07
Cadmium (Cd)	mg/kg	ND-19	< 5	< 5	< 5	< 5	< 5	<5	<1	<5	3.51	<5	< 5	<5		2.99	5	< 5	<5	1.06	<1	1.34	3.3
Chromium (Cr)	mg/kg	ND-168	62.13	17.122	14.14	< 5	< 5	21.87	<5	<5	27.4	<5	< 5	<5		9.85	25	13.1	<5	7.7	< 18.3	8.97	92
Cobalt (Co)	mg/kg	ND-30	<20	< 20	<20	< 5	<20	<20	<5	<20	1.76	<20	<20	<20		1.36	20	<20	<20	2.2	<20	27.7	9
Lead (Pb)	mg/kg	ND-148	5.89	73.65	< 5	< 5	< 5	25.84	7.05	<5	71.4	137	< 5	<5		37.6	33.9	< 5	<5	11.8	< 1.16		100
Manganese (Mn)	mg/kg	ND-512	115	116	7	< 5	<20	72	< 100	<20	68.1	<20	<20	103		44.2	21.6	26	<20		< 100		390
Mercury (Hg)	mg/kg	ND-3.1	< 0.1	0.15	< 0.1	< 0.1	< 0.1	0.29	< 0.12	0.026	0.303	< 0.01	< 0.1	0.046	0.568	0.22	0.24	< 0.1	0.028	0.007	< 0.12	ND	0.8
Nickel (Ni)	mg/kg	ND-730	29.39	7.716	< 5	< 5	< 5	<5	< 9.19	<5	18.9	<5	< 5	12.7		25.2	5	< 5	<5	5.5	< 9.19	4.27	65
Selenium (Se)	mg/kg	ND-74.3	< 5	< 5	< 5	< 5	< 5	<5	6.8	<5	1.01	<5	< 5	<5		0.1	3	< 5	<5	0.2	< 2.94	0.661	2.1
Chlorine (Cl)	mg/kg	ND-9080	<1000	0.15	1003	<1000	<1000	<1000	<800	230	1670	6730	<1000	2570	7680	1640	550	7210	<1000		<800	-	4200
Fluorine (F)	mg/kg	ND-178	<200	<200	<200	<200	<200	<200	<200	<178	43	<178	<200	<178		19.3	24	<20	<178		<200		65
Total Halogens	mg/kg	ND-9258	<1200	<200.15	<1203	<1200	<1200	<1200	<1000	<408	1713	<6908	<1200	<2748	7680	1659.3	574	<7230	<1178		<1000		
Sulfur (S)	mg/kg	740-61,300	4570	0.216	1890	<1000	3870	4260	200	0.42	400	0.2	2040	0.35	2200	0	5,500	1002	0.7		1500	2100	880
Nitrogen (N)	mg/kg	13,600-54,000				5200			6700	0.54	12,900	0.66		1.78	12800	16300	29,200		0.48		<1000		300
Volatile Organics	mg/kg	5 - 56				8			<1	ND		ND		ND		2.2			40	<1.0	<1	-	
Semi-volatile Organics	mg/kg	5 - 2090	-	-						142		299		308		<0.1			1370	<0.5		-	
Energy Content (from testing)	BTU/lb	Min req. = 5,000	5,679	9,607		8,050		7,806	7,470	13,070	14,500	10,330	8,020	7,078	12,484	11,750	8,500	5,350	17,950		9,195		8,200
Energy Content (from research)	BTU/lb	Min req. = 5,000	6,500		7,000		12,000			16,000				8,000	5,400			11,000	19,000			19,000	
*Data from EPA Comfort Letter da	ted June 3, 2	011																					
Key																							
Parameter not tested.																							
Parameter above the range for coa	al.																						
Detection level higher than coal u	oper limit.																						

Table 4-3 is primarily composed of data analysis performed by GCC on fuel samples provided by the fuel suppliers, with some noted supplementation with publicly available data.

As noted in the table, some AF samples contained an amount of fluorine above the upper limit for the contaminant range for coal or the non-detect (ND) limit of the test for fluorine was above the upper limit for the contaminant range for coal. GCC has summed the balogens (fluorine and chlorine, called "Total Halogens" in Table 4-3) to show that their combined amounts are comparable to, or lower than, the amount of halogens in coal. U.S. EPA has previously stated that it is acceptable to group contaminants based on similar physical and chemical properties, such as low-volatile metals or halogens, which influence behavior in combustion units prior to the point where emissions occur.¹⁵ In regards to halogens, U.S. EPA stated "Grouping of the total halogens chlorine and fluorine would be appropriate," with the caveat that this would need to be evaluated on a "case-bycase basis." ¹⁶ U.S. EPA reiterates this point in several comfort letters, including those previously cited, where contaminants were grouped because individual contaminant levels exceeded the range of coal contaminant levels. ^{17,18,19}

In regards to specifically fluorine, U.S. EPA has confirmed several times, through comfort letters, that a test result of "less than 200 ppm" is "comparable" to coal.^{20,21} In one letter, U.S. EPA specifically addresses the same situation of fluorine tests with an ND limit of 200 ppm, in confirming an engineered fuel as a non-waste:

"... the detection limit for fluorine (<200 ppm as tested for all three groups of fuels) is slightly higher than the level for the cited coal values in the table (178 ppm), but is also within a small acceptable range."²²

Therefore, with the majority of GCC's proposed AFs having less than 200 ppm of fluorine (based on the ND limit), the AFs would satisfy the contaminant legitimacy criteria without grouping halogens.

In summary, all of the proposed fuels meet the legitimacy criterion for contaminant levels when compared to coal. This conclusion is also based on the assumption that additional constituents for which the some of the AFs are not tested are present at levels comparable to or less than those in coal based on GCC's knowledge of the material. GCC will also subject AFs to comprehensive testing before introduction into the fuel stream.

Currently available research on several of the fuels is summarized below in support of the determinations in Table 4-2. GCC understands that it must verify that "Category 3" AFs used in the Facility's kiln meet NHSM criteria, despite previous U.S. EPA confirmation or determination of a similar AF as non-waste.

GCC Dacotah, Inc. | Permit Application for Alternative Fuels

Trinity Consultants

¹⁵ 78 FR 9146.

¹⁶ 11/12/2015 EPA Response To Evergreen Recycling Solutions Regarding Evergreen Fuel

^{17 8/22/2013} EPA Response To Waste Management Regarding Specfuel

¹⁸ 6/4/2014 EPA Response To N-Viro International Corporation Regarding Biosolids

^{19 11/8/2016} Non-Hazardous Secondary Materials (NHSM) Clarification Letter Regarding BDF

²⁰ 3/16/2012 EPA Response To DTE Energy Services Regarding Biosolids

²¹ 11/12/2015 EPA Response To Evergreen Recycling Solutions Regarding Evergreen Fuel

²² 4/3/2010 EPA Response To Lhoist Regarding Engineered Fuel Products

Biosolids

U.S. EPA has previously identified biosolids, which are generated from municipal wastewater treatment plants (WWTPs) as an "emerging material" in regards to their use a fuel in cement kilns.²³ WWTPs generate over 7,000,000 dry short tons of biosolids that can be beneficially reused or disposed, but are often left to accumulate at publicly owned treatment works (POTWs) or applied to land.²⁴ Biosolids represent a large and continuously-generated fuel supply for cement kilns, and are already being utilized. 12% of biosolids from the Sanitation Districts of Los Angeles (SDLAC) are already injected into a cement kiln, reducing the levels of NO_x emissions from the facility.²⁵

U.S. EPA has previously approved biosolids (or "biomass") and their derived fuels as meeting NHSM criteria through comfort letters, as described below:

- In the "12/15/2011 EPA RESPONSE TO DELHI CHARTER TOWNSHIP REGARDING BIOSOLIDS," a township had requested confirmation a "biofuel product" from its wastewater treatment sludge would meet NHSM criteria. EPA found that "the proposed sludge pellets that will be generated by the Delhi Charter Township (or Township) Wastewater Treatment Plant and burned in combustion units as a non-waste fuel," because the sludge was sufficiently processed into a fuel that met NHSM legitimacy criteria.
- ➤ In the "3/16/2012 EPA RESPONSE TO DTE ENERGY SERVICES REGARDING BIOSOLIDS," DTE Energy Services, Inc. (DTEES) requested confirmation from EPA that processed biosolids, initially generated by the Detroit Water and Sewerage Department (DWSD), would meet NHSM criteria "when burned for energy recovery in combustion units." EPA considered the processed biosolids a non-waste fuel based on the information provided by DTEES.
- ➤ In the "6/4/2014 EPA RESPONSE TO N-VIRO INTERNATIONAL CORPORATION REGARDING BIOSOLIDS," N-Viro International Corporation (N-Viro) requested confirmation that "various blends of biosolids from multiple waste water treatment facilities" mixed with "admixtures" such as fly ash, cement kiln dust, lime kiln dust, or lime, would meet NHSM criteria. EPA confirmed that this biosolid derived fuel would meet NHSM criteria.
- In the "11/8/2016 NON-HAZARDOUS SECONDARY MATERIALS (NHSM) CLARIFICATION LETTER REGARDING BIOMASS DERIVED FUEL," VMS Environmental Department (VMS) requested confirmation that a biomass (biosolid) derived fuel, composed of "discarded household and commercial waste ([Municipal Solid Waste] MSW)" would be considered non-waste fuel. EPA confirmed the fuel met NHSM criteria.

U.S. EPA approval of these fuels was contingent upon the fuel continuing to meet the processing criteria and legitimacy criteria found in the NHSM rule. GCC would comply with the applicable regulations so that any biosolids or biosolid derived fuel also continuously met NHSM criteria.

²³ EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."

²⁴ North East Biosolids and Residuals Association. 2007. A National Biosolids Regulation, Quality, End Use & Disposal Survey.

²⁵ EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."

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Refuse Derived Fuels (RDFs)/Engineered Fuels

There are numerous examples of EPA confirming that RDFs/engineered fuels of varying compositions meet NHSM criteria. 26,27,28,29,30,31,32,33,34,35,36 Typically, RDFs/engineered fuels are composed of varying amounts of some, or all, of the following raw materials:

- > Plastic
- > Paper
- > Textiles
- Fiber (textile and paper)
- Cardboard
- > Rubber
- Oils
- Soy-based inks
- Waxes
- > C&D material
- Industrial, retail, and residential wastes
- Municipal solid waste (MSW)
- > Recyclables
- Biosolids/biomasses

Various RDFs are manufactured by third parties prior to being transferred to the Facility. The overall process begins with the acceptance of source materials at a materials recovery facility (MRF). The source materials are generally in the form of commingled municipal, commercial and institutional waste streams, such as those listed above. The MRF, which is specifically designed to handle the source materials, receives, sorts, processes, and stores recyclable materials such as plastic, glass, and ferrous and non-ferrous metals. The appropriate materials from the MRF, which are those that are beneficial as fuel, represent the primary feedstock for the RDF. The primary feedstock is processed into RDF at the MRF or transported and processed at a separate engineered fuel processing facility.

The primary RDF feedstock can also be augmented by several different types of materials and/or NHSMs in the fuel production process. Commercial, institutional and industrial (C&I) byproducts with known composition are also added to the primary feedstock to improve the overall fuel characteristics.

EPA has noted that processors use a combination of source control, inspection, sorting and screening to meet customer specifications for other fuels.³⁷ Although certain equipment components and the type/brand of the

²⁶ 10/5/2011 EPA Response to International Paper Products Corporation Regarding Paper

²⁷ 11/14/2011 Fuel Pellets and the Definition Of Solid Waste When Burned in a Combustion Unit in Accordance with 40 CFR

²⁸ 4/3/2012 EPA Response to Lhoist Regarding Engineered Fuel Products

²⁹ 8/4/2012 EPA Response to Recommunity Regarding Reengineered Feedstock

^{30 2/6/2013} EPA Response to Roaring Springs Regarding Fuel Cubes

³¹ 5/8/2013 EPA Response to VEXOR Technology Regarding Engineered Fuel from Industrial Sources

^{32 8/22/2013} EPA Response to Waste Management Regarding Specfuel

^{33 12/9/2013} Status of Engineered Solid Refuse Fuel (SRF) Under the Non-Hazardous Secondary Materials (NHSM) Rule

^{34 9/29/2014} EPA Response to WERC-2, Inc. Regarding Process Engineered Fuel

^{35 10/31/2014} EPA Response to Pellet America Corporation Regarding Fuel Pellets

³⁶ 11/12/2015 EPA Response to Evergreen Recycling Solutions Regarding Evergreen Fuel

³⁷ Additions to List of Section 241.4 Categorical Non-Waste Fuels; April 14, 2014 proposed rule; Page 21011.

processing equipment will vary between processors, the conceptual process operations being described for RDF are functionally equivalent to that presented in other clarification letters EPA has issued for engineered fuels, and generally consist of initial sizing, contaminant removal/fuel quality improvement, and final blending/sizing.

Ultimately, while each RDF/engineered fuel is different depending on its composition, EPA has established several times that the initial composition is not what allows an AF to be considered a non-waste. It is determined by whether or not the fuel is (1) processed sufficiently and (2) meets the three legitimacy criteria regarding handling, contaminant levels, and meaningful heating value. The letter addressed to VEXOR Technology from the EPA (dated March 14, 2013, Appendix B) demonstrates this, particularly in regards to contaminant levels in the RDFs/Engineered fuels:

"Since VEXOR Technology plans to use different mixes of approved components to meet customer product specifications for different fuel products, our determination is contingent upon VEXOR Technology's plan to continue to meet the contaminant specifications listed in the enclosed chart."³⁸

VEXOR Technology explained that their fuel composition was variable, based on the end-product desired by their customers. EPA accepted VEXOR technology's assurance that their final fuel product would be tested to "ensure that it meets the... contaminant legitimacy criteria." GCC will also ensure the RDFs/engineered fuels that they use in the kiln, through suppliers data or their own testing, satisfy the NHSM rule to be considered non-waste fuels.

Oil Filter Fluff/Oily Solids

Oil filter fluff is a type of used oily solid, which is a mixture of used oil fuel and solids. This can be further categorized based on if the used oil is on-specification or not on-specification, based on the contaminant thresholds in Table 4-1. Oil that has been used for its lubricating properties (used oil) and has been demonstrated to meet the specifications of 40 CFR 279.11 is considered to be on-specification used oil fuel and is not subject to the NHSM criteria when utilized for energy recovery (it is included in the definition of traditional fuels at 40 CFR 241.2(3)). On-specification used oil fuel, and mixtures of on-specification used oil fuel with products, are considered to be on-specification used oil fuel (40 CFR 279.10(c)(2)), and are therefore defined as traditional fuels. Both on-site and off-site generated oil/oily solids may be received at the Facility as traditional fuels. GCC maintains documentation of the on-specification determination for all materials containing on-specification used oil fuel that are used for energy recovery.

Oil filter fluff which contains used oil, that does not meet on-specification standards, to be utilized for energy recovery must be demonstrated to meet the non-waste criteria of the NHSM rule before it can be utilized for energy recovery in the cement kiln. Oil filter fluff has been previously approved as a non-waste fuel, contingent upon meeting the processing requirements and legitimacy criteria in the NHSM Rule, via a comfort letter, implying that the used oil in the filter fluff is not on-specification.³⁹ "Sufficient processing" consisted of shredding, screening, and metal removal using a magnet. The aforementioned letter also described how the processed oil filter fluff would be managed as an analogous traditional fuel and has a heating value of 12,000 to 13,000 Btu/lb. The contaminant data in the letter is shown in Table 4-3. GCC will process and manage oil filter fluff, consisting of not on-specification used oil, in a manner similar to that described in the letter to ensure it is a non-waste fuel.

^{38 05/08/2013} EPA Response To VEXOR Technology Regarding Engineered Fuel From Industrial Sources

 $^{^{39}}$ 06/03/2011 EPA Response Letter: Waste Determination For Oil Filter Fluff That Is Burned In Combustion Units

Furniture Fiber Moterials from Carpet Recycling (Carpet Scrap)

Materials from carpet recycling (carpet scrap) was identified as an "emerging material" in 2008 by U.S. EPA and has already been used as an AF in cement kilns, aided by the organization Carpet America Recovery Act (CARE), an organization formed to promote diversion of commercial and residential carpet scrap from landfills to beneficial uses. Use of carpet scrap in cement kilns as a non-waste fuel has increased dramatically since 2008, when the amount was around 2 million pounds; in 2015 that number peaked at 120 million pounds, dipping down to 89 million pounds in 2016, representing about 20% of the use for recycled carpets. ⁴⁰ It should also be noted that carpet scrap is primarily composed of plastics, a material that is included as an ingredient in numerous fuels confirmed by EPA to be meet NHSM criteria, described further in the subsection on plastics.

Additional information about Furniture fiber as an NHSM is presented in a comfort letter in Appendix D.

Vehicle Fluff/Automobile Shredder Residue (ASR)

Automobile shredder residue (ASR) was identified as an "emerging material" by U.S. EPA and the PCA E&E Committee Alternative Fuels and Raw Materials (AFR) subcommittee. ASR contains the plastic and other non-metallic materials left after scrap automobiles are shredded, with about 5 million tons of ASR generated annually according to the Argonne National Laboratory in 2003. There has been previous research by automobile manufacturers, automobile recyclers, and the PCA regarding the use of ASR (or "vehicle fluff") as an AF in cement kilns. While there is potential for copper and mercury presence in ASR, as shown by the data in Table 4-3 these contaminants would be comparable to, or lower, than the contaminant levels of coal. GCC would continue to comply with the applicable requirements in the NHSM rule to maintain the ASR as a non-waste fuel. Further evidence that ASR meets NHSM criteril is provided in Appendix D.

Mixed Plastics

EPA has previously identified mixed plastics as an "emerging material" in regards to their use as a fuel in cement kilns, with several cement kilns already utilizing plastics as a non-waste fuel.⁴² Plastics potentially provide a large fuel supply, with nearly 30 million tons of plastic being generated from MSW and other sources annually.⁴³ A primary concern with the use of plastics is adequately removing chlorinated plastics to keep emission levels comparable to coal contaminant levels. However, cement kilns must limit the amount of chlorine fed into the kiln to maintain clinker quality, so chlorine would be limited regardless of required contaminant limits.⁴⁴

Many RDFs, as described in the RDF subsection, contain plastic as a minor or major ingredient. Most of the companies who received non-waste confirmations from EPA through comfort letters mentioned plastic as an ingredient, without disclosing precise RDF compositions, with two exceptions:

➤ In the "2/6/2013 EPA Response to Roaring Springs Regarding Fuel Cubes," U.S. EPA confirmed that a fuel cube produced by Roaring Spring Biofuel composed of 70% paper and 30% plastic would be considered a non-waste fuel, and it was noted that the recipe for the fuel cubes could vary with plastic comprising between 15 and 50%.

⁴⁰ CARE. 2017. CARE 2016 Annual Report.

⁴¹ EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."

⁴² EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."

⁴³ EPA. 2006. "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2006"

⁴⁴ EPA. 2008. "Cement Sector Trends in Beneficial use of Alternative Fuels and Raw Materials."

➤ In the "9/29/2014 EPA Response to WERC-2, Inc. Regarding Process Engineered Fuel," EPA confirmed that an engineered fuel produced by WERC-2, Inc. composed of 20-40% plastic and 5-10% polystyrene would be considered a non-waste fuel.

Further evidence that mixed plastics will meet NHSM criteria at this facility is provided in Appendix D.

Pulp and Paper Sludges

Per 40 CFR 241.4(a)(4), dewatered pulp and paper sludges used under specific circumstances (i.e. at the site of production) is considered a categorically exempt material and would therefore not need further analysis to meet NHSM criteria. GCC is proposing to use pulp and paper sludge, the same material in the categorical exemption, as an AF in the Facility's cement kiln. In updates to 40 CFR 241 on April 14, 2014, U.S. EPA stated that dewatered pulp and paper sludges "would or could meet the legitimacy criteria," implying that they could be used in instances other than at the site of production if it is shown that the sludges meet NHSM criteria. 45 Based on the information provided earlier in this section and Table 4-3, GCC proposes to use dewatered pulp and paper sludges as an AF on the basis that they are non-waste fuels.

Summary

As discussed, GCC will accept AFs through varied sources. AFs that are not traditional fuels or do not fall under a categorical exemption per 40 CFR 241.4(a) will be evaluated upon receipt to ensure that they are processed sufficiently and meet the legitimacy criterion outlined above. Should this not be the case, GCC will process the AFs to meet these requirements.

GCC can demonstrate with reasonable certainty that the AFs are a fuel which is "produced from the processing of discarded non-hazardous secondary materials." In order for GCC's AFs to be classified as a non-waste fuel, the legitimacy criteria must also be satisfied. Comparing the results of EPA contaminant data with the results of the GCC's contaminant analyses, the legitimacy criteria under 40 CFR 241.3(d)(1) are met in full as described in detail above. Thus, GCC has demonstrated that the AFs are considered a non-waste fuel rather than a solid waste under the final NHSM rule.

GCC proposes to utilize AFs to supplement the current permitted fuels being utilized in the kiln. This modification to allow AFs use is not expected to result in any emission changes for any pollutants at the facility except for CO. A detailed discussion of the impact of the use of AFs to each pollutant is provided below. Because the use of AFs results in a reduction to fossil fuel consumption while providing a more environmentally sound disposal option for NHSM materials at only a minimal impact to emissions, the overall environmental impact is expected to be positive.

5.1. OXIDES OF NITROGEN (NO_X)

In cement kilns, NO_x emissions are formed during fuel combustion by two primary mechanisms: fuel NO_x and thermal NO_x . Thermal NO_x comes from the oxidation of molecular nitrogen present in combustion air and fuel NO_x comes from the oxidation of nitrogen compounds in fuel. Because of the high temperatures involved in burning or clinker formation, thermal NO_x is the dominant mechanism for NO_x formation in kiln system.

High temperatures are necessary for the required clinkering reactions in the kiln. When a kiln's temperature drops, clinker formation reactions stop and the temperature must be raised by increasing the fuel input. Once the reactions resume, the temperature will increase rapidly, and again require adjustment to the fuel. These process variations, which are normal in cement kiln operations, result in temperature variations and can produce significant variations in emissions.⁴⁶

Also, longer residence times at high temperatures and greater amounts of oxygen in the combustion zone can increase NO_x . Each kiln has a different kiln temperature profile because of the unique chemical composition of the raw materials and the specific qualities of the clinker. Different raw materials require different flame temperatures. The raw material feed may also contain nitrogen compounds, which may lead to feed NO_x similar to fuel NO_x . However, the raw material feed will remain unchanged and the proposed AFs are expected to have a comparable or lower nitrogen content than the currently permitted fuels (see Table 4-3).

Although there is an inherent variability in thermal NO_x , fuel NO_x and feed NO_x are not expected to increase. Thus, NO_x emissions are not expected to change due to the AF project. GCC will continue to meet current NO_x permit limits, and continue to demonstrate compliance using NO_x CEMS. Therefore, no increase in NO_x emissions is expected. Current permit already has NO_x emission limit, which GCC will continue to meet.

5.2. CARBON MONOXIDE (CO)

CO emissions from cement kilns result from the kiln feed (feed CO) and the fuels (fuel CO). Feed CO is the main source of CO and is created as the feed is heated. A relatively small amount of fuel CO may be produced due to incomplete combustion of fuel. Feed CO emissions are not expected to change with the use of AFs, but fuel related CO emissions may increase.

Fuel CO emissions in a cement kiln are minimal when proper combustion conditions are maintained. However, because the AFs used will have larger particle sizes than traditional fuels, more fuel chips will drop into the lower zone of the calciner leading to more incomplete combustion. Therefore, GCC expects an increase in CO emissions with the proposed use of AFs.

⁴⁶ The U.S. EPA, Alternative Control Techniques Document Update – NOx Emissions from New Cement Kilns, November 2007, EPA-453/R-07-006.

GCC Dacotah, Inc. | Permit Application for Alternative Fuels Trinity Consultants

CO emissions for Kiln No. 6 is expected to increase by an additional 96 tons per year (tpy). See Section 6 for a detailed discussion on calculations for projected actual emissions and baseline actual emissions. Total facility-wide CO emissions from all other sources at the plant will remain unchanged. Thus, proposed CO emission increases are still below the major modification SER threshold of 100 tpy for PSD review. GCC will continue meeting the CO emission limit by demonstrating compliance using CO CEMS. In addition, GCC will continue to comply with current BACT of good combustion practices.

5.3. SULFUR DIOXIDE (SO₂)

SO₂ emissions from cement kilns are driven primarily by feed SO₂ formed due to sulfur in the form of metallic sulfides (pyrite), sulfate, or organosulfur compounds found in raw materials used to manufacture cement. The raw materials used in the kilns are not affected by the proposed use of AFs, thus feed SO₂ emissions are not expected to change. SO₂ emissions may also come from fuel SO₂ due to SO₂ formed from the oxidation of organic, pyritic, and sulfate sulfur in the kiln fuel. However, fuel SO₂ emissions is not expected to change because the proposed AFs are expected to have a comparable or lower sulfur content than the currently permitted fuels.

 SO_2 emissions will not change as a result of this AF project. GCC will continue to meet existing SO_2 permit limits, and continue to demonstrate compliance using SO_2 CEMS. Current permit already has SO_x emission limit, which GCC will continue to meet.

5.4. ORGANICS AND ORGANIC HAPS

Similar to CO emissions, THC emissions comes from feed THC and fuel THC. Feed THC is the dominant source of THC emissions and is created as the feed is heated and undergoes pyrolysis and/or volatilization. Because the raw materials used will not change, feed THC emissions are not expected to increase.

Fuel THC may result from the result of incomplete combustion of fuel in the kiln but a properly designed and operated cement kiln system minimizes VOC formation from fuel combustion. Combustion related VOCs are a minor component of total VOC emissions from a preheater/precalciner cement kiln because no combustion occurs in the flue gas stream after the potential generation of VOCs from raw materials.

In addition, PC MACT regulations limit cement kilns to a THC emission limit of 24 parts per million (ppm). Regardless of the type of fuel used, GCC will demonstrate compliance with the THC emission limit. During the PC MACT rule making process, the U.S.EPA noted⁴⁷:

"Because the standards are based on complete combustion of the fuel, and because of the extremely high temperatures in the end of the kiln where fuels are introduced (both those burn hazardous wastes and those do not), we believe that both type of kilns should achieve comparable complete destruction of organic materials present in the fuels under normal operating conditions reflecting good combustion."

Organics will be completely combusted due to the high operating temperature of the kilns. Therefore, GCC supports the conclusion that organic emissions will not change due to combustion of AFs. GCC will meet MACT and permit limits for THC, and demonstrate compliance using THC CEMS.

5.5. PARTICULATE MATTER (PM) AND PM HAPS

PM emissions from a cement kiln are primarily due to particulate matter loading from raw materials, along with a minimal amount of ash from fuels. The use of AFs will not affect the potential of the raw material feed to form PM. PM emissions are already controlled by the kiln baghouse and the proposed AF project will not change the flow rate through the control device will not increase and the capture efficiency of the filter media. In addition, the existing cement kiln will be subject to PM emission limits under PC MACT regulations. Regardless of the type of fuel used, GCC will demonstrate compliance with the PM emission limit.

It is expected that PM emissions will not change as a result of this AF project. GCC will continue meeting MACT and permit limits for PM, and continue to demonstrate compliance using PM Continuous Parametric Monitoring System (CPMS).

Particulate Matter Emissions from Alternative Fuel Handling and Storage

Currently, GCC is planning to have the handling and storage of AFs occur primarily outside of the facility. GCC plans to have third-party contractors supply a large amount of combustible-ready AFs to the facility when such fuels are needed and available. Therefore, GCC does not expect there to be any increase in particulate related emissions from the storage and handling of AFs at the Facility at this time, from the current emissions due to storage and handling of currently permitted fuels. If GCC finalizes facility designs that require a change from current storage or handling of fuels used on-site, GCC will submit the appropriate permit modification application, miscellaneous process application forms, and associated fees for this operation which is expected to have negligible emissions.

5.6. HYDROCHLORIC ACID (HCL) AND MERCURY (HG)

HCl and Hg emissions from cement kilns are primarily related to the composition of the raw materials used in the process. With regards to Hg and HCl emissions from cement plants, the U.S. EPA noted:⁴⁸

"We reasoned that emissions of these constituents were a function of raw material concentrations."

Use of AFs will not affect the potential of the raw material feed to form Hg or HCl. Therefore, HCl and Hg emissions are not expected to change as a result of the combustion of AFs. Under PC MACT regulations, existing cement kilns are subject to an Hg emission limit of 55 lb of Hg per MM ton of clinker and an HCl limit of 3 ppm. Regardless of the type of fuel used, GCC will meet MACT Hg and HCl limits, and will demonstrate compliance using CEMS.

5.7. DIOXIN AND FURANS (D/F)

D/F emissions from cement kilns are a primary function of exhaust gas residence time and PM loading, which is independent of fuel type. In a letter to the Center for Maximum Potential Building Systems, the U.S. EPA similarly noted:⁴⁹

"We believe that dioxin emissions from cement kilns in operations today are not a function of the fuels used in the manufacturing process, but rather occur primarily as a result of formation in the air pollution control system when favorable conditions for its formation are present. The recent EPA air standards have caused alterations to the

⁴⁸ Federal Register/Vol. 75, No. 174/Thursday, September 9, 2010, 54972.

⁴⁹ Letter from Susan Parker Bodine (U.S. EPA) to Gail Vittori (Center for Maximum Potential Building Systems) dated December 10, 2007.

emission control system designs and changes to the way the cement kilns are operated that minimize the potential for dioxin formation. Because emission standards applicable to cement kilns burning conventional fuels and to kilns burning hazardous waste fuels are the same for dioxin, dioxin emissions cannot be significantly different between them."

Therefore, D/F emissions are not expected to change as a result of the use of AFs. GCC will continue monitoring temperature of the exhaust gases from the kiln as required by MACT Subpart LLL and will continue meeting the existing temperature limits.

For the reasons described above and based on the information available to GCC at this time, GCC expects no increases in emissions for any of the regulated pollutants due to the proposed use of AFs in the kiln with the exception of CO. Except for an increase in CO, no additional emission changes of criteria pollutants attributed to the introduction of additional AFs in the kiln is requested for currently permitted levels. The tables below provide a summary of applicable pollutants and the expected impact due to this AF project.

Table 5-1 below provides a summary of current Project Actual Emission (PAE) level for Kin 6 system (kiln, coal mills, and alkali by-pass). Please note current PAE levels are not permit limits.

Table 5-1. Current and Future PAE Levels and Applicable MACT Limits

Pollutant	Current PAE Level in K6 Permit	Proposed PAE for K6	MACT Limit for Kiln	Continuous Monitoring Method	Changes Due to AFs	
СО	1,174.39 tpy	1,229.8 tpy	<u> </u>	CEMS	Yes	
NOx	1,975.38 tpy	No Change		CEMS	No	
SO ₂	734.75 tpy	No Change		CEMS	No	
THC/VOC	93.46 tpy	No Change	4	CEMS	No	
THC	-	No Change	24 ppmd	CEMS	No	
PM ₁₀ filterable and condensable	248.79 tpy	No Change	4	CPMS/Stack Test	No	
PM _{2.5} filterable and condensable	236.34 tpy	No Change	1	CPMS/Stack Test	No	
РМ	253.89 No Change 0.07 lb/ton of clinker CPM		CPMS	No		
Hg		-	55 lb/MM ton of clinker	CEMS	No	
HCl	HCl		3 ppmd	CEMS	No	
D/F			0.2 or 0.4 ng/dscm	CPMS	No	
CO ₂	CO ₂ 1,072,005 tpy		122	CEMS	No	

Table 5-2. Current Short-Term Limits

Pollutant	Current Limit in K6 Permit	Changes?	Continuous Monitoring Method	Changes Due to AFs
F-PM ₁₀	11.7 lb/hr	No Change	CEMS	No
NOx	979.2 lb/hr	No Change	CEMS	No
SO ₂	423.1 lb/hr	No Change	CEMS	No

Table 5-2 provides short-term emission limit for Kiln 6 system. As noted below, except for proposing a new PAE level for CO due to proposed AFs, there are no other emission changes.

The U.S. EPA defines a "major modification" as modification in which a physical change or change in the method of operation at a "major stationary" source results in a significant net emissions increase. Portland cement plants are considered PSD "major sources" if site-wide source emissions exceed 100 tpy of a regulated pollutant. Under this definition, the Facility is an existing PSD major source because the PTE of at least one PSD regulated pollutant exceeds 100 tpy.

The Facility has the potential to emit greater than 100 tpy of several PSD pollutants, and is therefore classified as an existing major stationary source under the PSD permitting program. Unless otherwise exempt, a change to an existing major source is considered to be a major modification if the net emissions increase resulting from the modification is greater than the PSD Significant Emission Rate (SER) threshold for the respective regulated NSR pollutant. A structured step-by-step procedure to evaluate PSD applicability is used, in accordance with South Dakota and federal PSD regulations. The definitions of terms used in this section are consistent with the corresponding definitions found in 40 CFR 52.21.

An important part of the major modification definition in the PSD regulation is that a physical or operational change must result in an emissions increase above the significance threshold. The Clean Air Act (CAA) requires only those changes that cause emissions to increase to be to subject to PSD/NSR. If there is no causal relationship between a project and an emission increase, then PSD cannot be triggered.

The U.S. EPA clearly understood this concept when it promulgated the 1980 PSD regulations containing the causation criteria in the major modification definition. The U.S. EPA provided that a "major modification" will occur under the 1980 NSR rules only when there is a direct causal link between a non-exempt change and any subsequent emissions increase. In the preamble to the 1992 PSD rule amendments, the U.S. EPA reiterated the causal linkage when it wrote (57 FR 32326):

"The NSR regulatory provisions require that the physical or operational change "result in" an increase in actual emissions in order to consider that change to be a modification (see, e.g., 40 C.F.R. 52.21(b)(2)(i))."

In other words, PSD does not apply unless the source finds that there is a causal link between the proposed change and any post-change increase in emissions.

More recently, the U.S. EPA again confirmed the causal linkage in the December 2002 version of the PSD regulations. The 2002 regulations articulated the "demand growth" exclusion that originates from the causal link requirement of the Clean Air Act. Under the demand growth principle, only increases that result from a proposed physical or operational method change are to be taken into account (67 FR 80186):

"Both the statute and implementing regulations indicate that there should be a causal link between the proposed change and any post-change increase in emissions..."

Finally, the US EPA again wrote on September 14, 2006, in their proposed rule involving Debottlenecking, Aggregation, and Project Netting (71 FR 54235):

⁵⁰ GCC falls under the designation of "portland cement plant," which is identified in 40 CFR 52.21(b)(1)(i)(a) as having a major source PSD threshold of 100 tpy.

"As we explained in promulgating the demand growth exclusion, we interpret the "which increases" and "which results in" language of section 111(a)(4) of the modification provision of the CAA as requiring "a causal link between the proposed change and any post change increase in emissions.""

As discussed in the prior section, GCC does not have a reason to believe that emissions from the proposed use of additional AFs will change relative to the kiln's current emissions levels. Only CO emissions are anticipated to increase as a result of the use of proposed AFs due to an increase in the oxygen to reach the required heat for clinker production using the AFs. However, as discussed below, the increase in CO is below the SER level (100 tpy). Therefore, additional PSD review is not required and this AF project does not trigger PSD permitting requirements for a major modification. A detailed discussion of the emission calculations is provided below.

6.1. EMISSION CALCULATIONS FOR CO

The following procedure is used to determine if a major modification will occur as a result of the revised Project:

- 1. Calculate project emission increases: Under the PSD regulations in 40 CFR 52.21, the increase in emissions is calculated for new emission units, existing physically modified emission units, and existing emission units that will have an associated increase in throughput but will not be physically modified. For existing units, the increase in emissions is calculated as the difference between projected actual emissions (PAE) and baseline actual emissions (BAE). For new units, the increase in emissions is the potential to emit (PTE) of the unit. If the emission increase from the project alone is less than the SER for a regulated NSR pollutant, then PSD permitting is not triggered for that particular pollutant.
- 2. Calculate net contemporaneous and creditable emission increases and decreases: For all pollutants that will have emissions increases greater than the SER when only evaluating the project increase, a further analysis is used to determine the contemporaneous and creditable emissions increases and decreases that occurred during the five year period prior to the date construction is projected to begin on the project.⁵¹ If an emissions increase or decrease has been relied upon for a previous PSD permit, it is not creditable. Additionally, an emissions decrease is only creditable if the decrease is enforceable.⁵²
- Determine the net emissions increase: The emissions increase from the project alone is added to the net
 contemporaneous emissions change to determine the net emissions increase of a pollutant. If the net
 emissions increase is less than the respective SER, PSD permitting is not triggered for that particular
 pollutant.

6.1.1. BASELINE ACTUAL EMISSIONS (BAE)

Per Federal PSD regulations, BAE is defined as:

40 CFR 52.21(b)(48)(ii), baseline actual emissions means the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding the date the owner or operator begins the actual construction of the project, or the date a complete permit application is received by the Administrator for a permit required under this section.

^{51 40} CFR 52.21(b)(3)(ii)(a)

⁵² For the purposes of this application, it has been assumed that for an emissions decrease to be creditable, it must occur through a permitting action.

GCC reviewed the kiln's CO emissions for last ten years. April 2014 to March 2016 period represented the maximum CO emissions during a consecutive 24-month period. During this period, there were two months of inactivity due to yearly maintenance. The average CO emissions rate during the baseline period was calculated by summing the CO emissions from April 2014 to March 2016 and dividing by 2, which results in 1,079.7 tons CO per year (please refer to Appendix C for calculations).

40 CFR 52.21(b)(48)(ii)(a) The average rate shall include fugitive emissions to the extent quantifiable, and emissions associated with startups, shutdowns, and malfunctions.

Per 40 CFR 52.21(b)(48)(ii)(a), all startups, shutdowns, and malfunction emissions in the CEMS were also factored into the baseline period.

40 CFR 52.21(b)(48)(ii)(b) The average rate shall be adjusted downward to exclude any non-compliant emissions that occurred while the source was operating above an emission limitation that was legally enforceable during the consecutive 24- month period.

40 CFR 52.21(b)(48)(ii)(c) The average rate shall be adjusted downward to exclude any emissions that would have exceeded an emission limitation with which the major stationary source must currently comply, had the major stationary source been required to comply with such limitations during the consecutive twenty-four month period. However, if an emission limitation is part of a maximum achievable control technology standard that the Administrator proposed or promulgated under part 63 of this chapter, the baseline actual emissions need only be adjusted if the State has taken credit for such emissions reductions in an attainment demonstration or maintenance plan consistent with the requirements of §51.165(a)(3)(ii)(G) of this chapter.

Since the current kiln's CO emission PAE from the DENR Construction Permit No. 28.1121-02-03C application is 1,174.39 tons CO per year, the baseline period did not exceed the CO emission limit. Therefore, the baseline did not need to be adjusted downwards per 40 CFR 52.21(b)(48)(ii)(b)&(c).

40 CFR 52.21(b)(48)(ii)(d) For a regulated NSR pollutant, when a project involves multiple emissions units, only one consecutive twenty-four month period must be used to determine the baseline actual emissions for the emissions units being changed. A different consecutive twenty-four month period can be used for each regulated NSR pollutant.

40 CFR 52.21(b)(48)(ii)(e) The average rate shall not be based on any consecutive twenty-four month period for which there is inadequate information for determining annual emissions, in tons per year, and for adjusting this amount if required by paragraphs (b)(48)(ii)(b) and (C) of this section.

Only the kiln's CO emissions are affected with this AF project and therefore 40 CFR 52.21(b)(48)(ii)(d)&(e) do not apply.

6.1.2. PROJECTED ACTUAL EMISSIONS (PAE)

Per Federal PSD Regulation 40 CFR 52.21(b)(41)(i), PAE is defined as:

40 CFR 52.21(b)(41)(i) The maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the 5 years (12-month period) following the date the unit resumes regular operation after the project, or in any one of the 10 years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that regulated NSR

pollutant and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the major stationary source.

GCC anticipates approximately 8.5% change in CO levels, which results in a projected CO emission factor of 3.45 lbs CO per ton clinker produced. Clinker production will not change and will remain at 3,300 tons per day averaged annually and 3,750 tons per day maximum, which results in PAE of 1,229.8 tons per year.

6.1.3. COULD HAVE ACCOMODATED (CHA)

Per Federal PSD Regulation 40 CFR 52.21(b)(41)(ii), CHA is a portion of the projected actual emissions defined as:

40 CFR 52.21(b)(41)(ii)(c) In determining the projected actual emissions under paragraph (b)(41)(i) of this section (before beginning actual construction), the owner or operator of the major stationary source: Shall exclude, in calculating any increase in emissions that results from the particular project, that portion of the unit's emissions following the project that an existing unit could have accommodated during the consecutive 24-month period used to establish the baseline actual emissions under paragraph (b)(48) of this section and that are also unrelated to the particular project, including any increased utilization due to product demand growth;

GCC believes that had the economic demand been present, the facility could have been able to accommodate additional clinker production during the 24-month baseline period. For the 2011 to 2017 production data used in BAE, GCC reviewed all 24-rolling months of production to determine the additional clinker production which could have accommodated (CHA) due to demand. This CHA clinker production is 33,739 tons per year above the clinker production during the CO baseline period. During the CO baseline period, the CO emission factor was 3.11 lbs CO per ton clinker produced. To calculate the CHA emissions, this emission factor was multiplied with the difference between the CHA clinker production and the monthly clinker production from April 2014 to March 2016. The total CHA emissions was calculated to be 53.7 tons per year (see Appendix C for calculations).

6.1.4. EMISSION INCREASES

Per Federal PSD Regulation 40 CFR 52.21(b)(23)(i), a SER is defined as:

40 CFR 52.21(b)(23)(i). Significant means, in reference to a net emissions increase or the potential of a source to emit any of the following pollutants, a rate of emissions that would equal or exceed any of the following rates: Carbon monoxide: 100 tons per year (tpy)

The emission increase calculated from PAE minus the BAE minus the CHA equals to 96 tons per year. The CO emission increase from the AF project remains below the SER limit of 100 tons per year, thus this AF project is not considered a major modification and GCC Dacotah is not subject to any of the major modification requirements. However, the PAE is greater than the current PAE level under Permit No. 28.1121-02-03C of 1,174.39 tons CO per year. Therefore, GCC would like to request an increase of the PAE level for kiln system CO to 1,229.8 tpy. GCC is not requesting any changes to the maximum clinker production limit.

As summarized in the table below, CO is the only regulated pollutant that is anticipated to have an increase as a result of this AF project. However, the increase in CO is below the SER level of 100 tpy and because there are no changes for other regulated pollutants, it can be concluded that this AF project does not trigger PSD permitting requirements for a major modification. Since the CO emission increase will remain below SER levels, the netting analysis of contemporaneous emission increases and decreases (Steps 2 & 3) does not have to be included.

As discussed above, there are no other changes to all other NSR regulated pollutant shown in the table below. Therefore, this project is not subject to DENR's PSD permitting requirements.

Table 6-1. NSR Regulated Pollutants and PSD SERs

Regulated NSR Pollutants	Changes Expected from project?	Significant Emission Rate _{a,b} (tpy)
Criteria Pollutants		
Carbon Monoxide	Yes	100
Oxides of Nitrogen	No	40
Sulfur Dioxide	No	40
Particulate Matter	No	25
PM ₁₀	No	15
PM _{2.5}	No	10
Ozone (VOC)	No	40
Lead (elemental)	No	0.6
Other Pollutants		
Greenhouse Gases (CO2e)b	No	Any
Fluorides (except HF)	No	3
Sulfuric Acid Mist	No	7
Hydrogen Sulfide	No	10
Total Reduced Sulfur Compounds	No	10
CFCs and Halons	No	Any
Municipal Waste Combustor (MWC) acid gases c	No	40
MWC metals ^d	No	15
MWC organicse	No	3.5E-06
Municipal Solid Waste Landfills Emissionsf	No	50

^a The SER of each non-GHG pollutant is established under 40 CFR 52.21(b)(23)(i).

b The SER for GHGs under 40 CFR 52.21(b)(23)(ii) is "any emission rate." Greenhouse gases are only subject to regulation under the federal PSD program as a regulated NSR pollutant when the conditions of 40 CFR 52.21(b)(49)(iv) and (v) are met. Per 40 CFR 52.21(b)(49)(iii), when GHGs are subject to regulation, the corresponding SER for GHGs at major stationary sources is 75,000 tpy CO₂e. For the purposes of this application, 75,000 tpy CO₂e will be treated as the SER hereafter.

c MWC acid gases are measured as sulfur dioxide and hydrogen chloride.

d MWC metals are measured as PM.

e MWC organics are measured as total tetra-through octa-chlorinated dibenzo-p-dioxins and dibenzofurans.

f Municipal solid waste landfills emissions are measured as nonmethane organic compounds.

The subsections that follow provide discussions on the federal and local rules and regulations that are applicable to the Facility.

7.1. NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)

This section provides a discussion on the NESHAP applicability and applicable emission limits for the proposed AF project.

Subpart A - General Provisions

All affected sources are subject to the general provisions of Part 63 NESHAP Subpart A unless specifically excluded by the source-specific NESHAP. These provisions include initial notification and performance testing, recordkeeping, and monitoring requirements for all other subparts as applicable. GCC will continue complying with provisions of Subpart A as applicable.

Subpart LLL - National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry

The Facility is an existing major source of hazardous air pollutants (HAPs) under Subpart LLL and is subject to several limits and requirements. Subpart LLL does not limit the types of materials or fuels that can be used in the kiln. However, kilns which burn hazardous waste, are subject to and are regulated under Subpart EEE - National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors, instead of Subpart LLL. As discussed earlier and supported by the justification provided in Section 4, the proposed AFs in this application are not considered as a hazardous waste; the proposed AFs are non-hazardous secondary materials (NHSMs) pursuant to the provisions of 40 CFR 241 Subpart B, *Identification of Non-Hazardous Secondary Materials that are Solid Wastes When Used as Fuels or Ingredients in Combustion Units* (NHSM Rule). Therefore, the kiln will continue being subject to the PC MACT Subpart LLL.

U.S. EPA amended PC MACT regulations. Amended regulations now include more stringent emission limits for PM, THC, Hg, and HCl. GCC has complied with these new limits since they went into effect on September 9, 2015.

Provisions in 40 CFR §63.1348 (c) requires a new performance test for D/F if the subject facility undertakes operational changes that may adversely affect compliance with the applicable standards under Subpart LLL. Subpart LLL establishes the emission limits for PM, D/F, THC, Hg, and HCl. As discussed in earlier sections, the proposed use of AFs does not affect the Portland cement manufacturing emissions. Therefore, GCC is also requesting that the proposed AF project is a change that will not adversely affect compliance as stipulated under 40 CFR 63.1348 (c), whereby authorization is not required under 40 CFR 63.1348 (c) prior to implementation of AF use.

7.2. NEW SOURCE PERFORMANCE STANDARDS (NSPS)

Subpart A - General Provisions

All affected sources subject to NSPS are also subject to the general provisions of NSPS Subpart A unless specifically excluded by the source-specific NSPS.

NSPS potentially apply to constructed, reconstructed, or modified sources. 40 CFR §60.2 defines construction as fabrication, erection, or installation of an affected facility. As discussed earlier, the proposed AF project does not involve construction of any newly affected facilities under Subpart F, therefore this AF project is not considered a new construction under NSPS.

40 CFR §60.15 defines reconstruction as the replacement of components of an existing facility to such an extent that the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility, and it is technologically and economically feasible to meet the applicable standards. The proposed AF project does not involve replacement of components of Subpart F affected facilities, therefore it is not considered a reconstruction under NSPS regulations.

40 CFR §60.14 defines modification as any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted. The proposed AF project will not result in increase of emissions of NO₂, SO₂, or PM, therefore, this AF project is not subject to NSPS §60.14 provisions.

As such, NSPS subparts that could potentially be applicable to the proposed AF project are discussed in more detail below.

Subpart F - Standards of Performance for Portland Cement Plants

NSPS Subpart F applies to the following affected facilities at Portland cement plants that are constructed, reconstructed, or modified after August 17, 1971: kilns, clinker coolers, raw mill systems, finish mill systems, raw mill dryers, raw material storage, clinker storage, finished product storage, conveyor transfer points, bagging and bulk loading and unloading systems. Subpart F regulates PM, SO_x , and NO_x emissions with newer and more stringent standards for kilns that were constructed or modified after June 16, 2008. This kiln was constructed after August 17, 1971 and has not been modified after June 16, 2008. Therefore this kiln is currently subject to the existing NSPS Subpart F requirements for units constructed after August 17, 1971 and not subject to the existing NSPS Subpart F requirements for units modified after June 16, 2008.

In 2012 K6 permit issuance's Statement of Basis, DENR concluded:

"GCC Dacotah's upgrade to Kiln #6 is not considered construction, reconstruction or modification after June 16, 2008. Therefore, the new kiln emission limits from 40 CFR Part 60 Subpart F does not apply. GCC Dacotah's application notes that Kiln #6 was previously modified after August 17, 1971, and is subject to the existing kiln emission limits from 40 CFR Part 60 Subpart F."

DENR also established short-term emission limits for the kiln system as Permit Condition No. 7.3 to ensure that future PM, NO_2 , and SO_2 emissions from the upgraded Kiln No. 6 system remains well below the historical levels.

The NSPS regulations in 40 CFR §60.2 define modification as any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted. As discussed in earlier sections, the PM, NOx, and SO_x emissions are not expected to increase. GCC does not anticipate any revisions to Kiln No. 6 combined emission limit for kiln/coal mill/ABP in Permit Condition No.7.3. Therefore, Kiln No. 6 system will not be considered as a modified facility under NSPS Subpart F. Therefore, this AF project is not considered as a modification under NSPS provisions. As a result, this kiln will continue to be subject to NSPS Subpart F

requirements for units constructed after August 17, 1971 and not subject to the existing NSPS Suhpart F requirements for units modified after June 16, 2008. GCC will continue to comply with other applicable NSPS Subpart F requirements. The kiln is also subject to NESHAP Subpart LLL, as noted in the previous section, which is more stringent than the currently applicable NSPS Subpart F requirements. GCC's compliance with NESHAP Subpart LLL therefore guarantees compliance with the applicable NSPS Subpart F requirements.

Subpart Y - Standards of Performance for Coal Preparation Plants

NSPS Subpart Y establishes standards for performance for PM for each of the following facilities located at coal preparation and processing plants that process more than 200 tons of coal per day: coal processing and conveying equipment (including breakers and crushers), coal storage systems, and coal transfer and loading systems. The applicable limits for a facility is dependent on its date of construction, reconstruction, or modification.

The Facility contains several pieces of equipment subject to Subpart Y, including transfer towers for raw material and coal, truck and railcar unloading of raw materials, and a storage building for raw materials. This facility will be unaffected by the proposed AF project, because the proposed AF project involves changes only to fuel used in the cement kiln, not the handling of raw materials used in clinker production or the handling of coal. The only change may be a reduction in emissions from these coal handling facilities, due to a decreased use of coal.

The proposed AF project will also not involve the installation/modification of coal preparation and processing affected facilities under NSPS Subpart Y. Therefore, Subpart Y is not applicable to this AF project.

Subpart 000 - Standards of Performance for Non-metallic Mineral Processing Plants

NSPS Subpart OOO sets forth the standards of performance for PM for each of the following facilities located at fixed or portable nonmetallic mineral processing plants that are constructed, modified, or reconstructed after August 31, 1983: crusher, grinding mill, screening operation, bucket elevator, helt conveyor, bagging operation, storage bin, and enclosed truck or railcar loading station.

Only one piece of equipment at the Facility is currently subject to Subpart 000: the primary crusher system. This system receives quarried raw materials at the crusher hopper, feeds the material to the emissions control plan crusher, crushes, and conveys/transfers the materials to the limestone/shale dome through transfer towers. This system will be unaffected by the proposed AF project, because the proposed AF project involves changes only to fuel used in the cement kiln, not the raw materials used in clinker production.

The proposed AF project will also not involve the installation/modification of nonmetallic mineral affected facilities under NSPS Subpart 000. Therefore, Subpart 000 is not applicable to this AF project.

Subpart CCCC - Standards of Performance for Commercial and Industrial Solid Waste Incineration Units (CISWI)

NSPS Subpart CCCC establishes standards for CISWI units, including preconstruction requirements that apply to planning the CISWI unit and operating requirements such as emission limits. Subpart CCCC emission limits apply to nine air pollutants (i.e., particulate matter, carbon monoxide, dioxins/furans, sulfur dioxide, nitrogen oxides, hydrogen chloride, lead, mercury, and cadmium) from four categories of solid waste incineration units: municipal solid waste; hospital, medical and infectious solid waste; commercial and industrial solid waste; and

other solid waste. CISWI emission limits are more stringent than the PC MACT Subpart LLL emission limits and requirements.

Currently, the kiln utilizes coal and petroleum coke as the primary fuel and utilizes natural gas as fuel during startup and as a supplemental back-up fuel; therefore the facility is not subject to requirements of CISWI. As explained in Section 3, and further elaborated upon in Section 4, the proposed AFs are classified as NHSM under 40 CFR 241 Subpart B and do not meet the definition of municipal solid waste; hospital, medical and infectious solid waste; commercial and industrial solid waste; and other solid waste. Therefore, the Facility will continue to not be subject to Subpart CCCC.

Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

NSPS Subpart IIII sets forth the standards of performance for stationary compression ignition (CI) internal combustion engines (ICE).

Subpart IIII applies only to the two diesel generators at the Facility. The proposed AF project will also not involve the installation/modification of stationary compression ignition (CI) internal combustion engines (ICE) affected facilities under NSPS Subpart IIII. Therefore, Subpart IIII is not applicable to this AF project.

7.3. STATE REGULATORY REQUIREMENTS

In addition to the federal air regulations described above, DENR establishes regulations in the applicable at the emission unit level and at the facility level. The rules, established in the Applicable Rules of South Dakota (ARSD), also contain requirements related to the need for construction and/or operating permits. The rules potentially applicable to the emission units affected by the proposed AF project at the Facility are detailed in the following sections.

- > ARSD 74:36:01 Definitions
 - ARSD 74:36:01 provides definitions of terms and phrases used throughout the ARSD and in permits issued to facilities.
- > ARSD 74:36:02 Ambient Air Quality
 - O ARSD 74:36:02 establishes air quality goals and ambient air quality standards for the state of South Dakota. ARSD 74:36:02:02 lists ambient air quality standards, by reference to 40 CFR 50, and states that "no person may cause these standards to be exceeded." Since the AF project does not result in a significant net emission increase of any regulated NSR pollutant, the post-project emissions from the Facility will not result in an exceedance of an ambient air quality standard. Please refer to Section 6 of this application for additional information on the significant net emission increase calculations.
- > ARSD 74:36:03 Air Quality Episode
 - o There are no portions of ARSD 74:36:03 that apply to the proposed AF project.
- ARSD 74:36:04 Operating Permits For Minor Sources
 - o The Facility is not a minor source of air pollutants because potential emissions of a number of criteria pollutants are greater than 100 tons per year. As such, there are no portions of ARSD 74:36:04 that apply to the proposed AF project.

- > ARSD 74:36:05 Operating Permits for Part 70 Sources
 - o The Facility is a Part 70 Source and therefore, Rule 74:36:05, applies to the facility. ARSD 74:36:05 establishes the procedures for obtaining and modifying a Part 70 operating permit from DENR.
 - O As described under ARSD 74:36:05:08, a person who owns or operates a Part 70 source is required to submit a timely and complete application to DENR for emission units involved with a modification. A Title V permit modification application is timely if it is submitted to the DENR within twelve months after commencing operation of the AF project. An application is complete if it meets the requirements cited in ARSD 74:36:05:12 and ARSD 74:36:05:13.
 - GCC will submit a timely and complete Title V permit modification application within twelve months after commencing operation of the AF project. Within the twelve month period prior to submitting the timely and complete permit application to DENR and until DENR issues a modified Title V Operating Permit, GCC will operate the emission units affected by the AF project under the construction permit issued by DENR.
- > ARSD 74:36:06 Regulated Air Pollutant Emissions
 - ARSD 74:36:06 outlines emission standards for fuel burning units, process industry units, incinerators, and waste wood burners. GCC does not operate waste wood burners at the Facility.
 - o Per ARSD 74:36:01:01(31), "fuel burning unit" is defined as follows: a furnace, boiler, apparatus, stack or any of their components used in the process of burning fuel or other combustible material for the primary purposes of producing heat or power by indirect heat transfer. The Kiln 6 does not produce heat by indirect heat transfer. Additionally, there are no other combustion units that are impacted by the AF project. As such, the emission standards for fuel burning units codified at ARSD 74:36:06:02 do not apply to emission units affected by the AF project.
 - o Per ARSD 74:36:01:01(35), "incinerator" is defined as follows: a furnace used to burn solid waste to reduce the volume of the waste by removing its combustible material. GCC does not combust solid waste at the Facility with the intention of reducing waste volume. As such, the emission standards for incinerators codified at ARSD 74:36:06:04 do not apply to emission units located at the Facility.
 - GCC does not operate process industry units at the Facility that are impacted by the AF project.
 The alternative fuels handling and processing will occur outside of the facility.
- > ARSD 74:36:07 -- NSPS
 - o ARSD 74:36:07 incorporates the NSPS codified at 40 CFR 60 by reference. Please refer to previous section of this report for information on NSPS applicability to the AF project.
- ➤ ARSD 74:36:08 NESHAP

ARSD 74:36:08 incorporates the NESHAP codified at 40 CFR 61 and 40 CFR 63 by reference.
 Please refer to previous section of this report for information on NESHAP applicability to the AF project.

> ARSD 74:36:09 - PSD

o ARSD 74:36:09 incorporates the PSD regulations codified at 40 CFR 52.21 by reference. Please refer to Section 6 of this report for information on PSD applicability to the AF project.

> ARSD 74:36:10 - New Source Review

O ARSD 74:36:10 applies to areas of the state, which are designated as nonattainment areas. As of the date of this application, there are no areas in the state of South Dakota that are listed as nonattainment for any pollutant regulated under the Clean Air Act. Therefore, this rule does not apply to the proposed AF project at the Facility.

ARSD 74:36:11 - Performance Testing

ARSD 74:36:11 establishes performance testing methods by reference of 40 CFR 60, 40 CFR 63, and 40 CFR 51. Should DENR require GCC to conduct any performance testing on emission units impacted by the AF project, GCC will notify DENR at least ten days prior to the start of the performance test and will provide DENR with results of the performance test within 60 days after completion of the test.

> ARSD 74:36:12 - Control of Visible Emissions

- O ARSD 74:36:12:01 states that a source may not discharge into the ambient air from a single unit of emissions an air pollutant of a density equal to or greater than that designated as 20 percent opacity. The opacity requirement does not apply if the presence of uncombined water is the only reason for failure; if smoke is emitted for the purpose of DENR approved training or research; or for brief periods during operations as soot blowing, start-up, shut-down, and malfunctions.
- GCC will continue to comply with the opacity requirements specified at ARSD 74:36:12 for all emission units impacted by the AF project.

ARSD 74:36:13 – CEMS

- o ARSD 74:36:13.01 states that DENR may require major stationary air pollution sources to install, calibrate, operate, and maintain equipment approved by DENR for the continuous monitoring and recording of emission data in order to determine compliance with a regulated air pollutant standard or where there is reason to believe there is a violation.
- o GCC currently operates a NO_x, SO₂, CO, THC, and CO₂ CEMS on Kiln 6. GCC will continue to comply with the requirements specified in ARSD 74:36:13 for the existing CEMS in operation on Kiln 6. Additionally, should DENR require a CEMS for another pollutant or on a separate emission unit, GCC will follow the requirements outlined in ARSD 74:36:13.

ARSD 74:36:16 – Acid Rain Program

o There are no portions of ARSD 74:36:16 that apply to the proposed AF project.

- ARSD 74:36:17 Rapid City Street Sanding And Deicing
 - o There are no portions of ARSD 74:36:17 that apply to the proposed AF project.
- > ARSD 74:36:18 Regulations for State Facilities in the Rapid City Area
 - o There are no portions of ARSD 74:36:18 that apply to the proposed AF project,
- > ARSD 74:36:20 Constructions Permits for New Sources or Modifications
 - o Per ARSD 74:36:20:02, a person may not construct, install, modify, or operate any source or unit likely to cause the emission of air pollutants into the ambient air or any equipment that prevents or controls the emission of air pollutants into the ambient air until a construction permit has been issued by the DENR. This application serves as GCC's requirement to submit an application for a construction permit to be issued by the DENR.
- > Complete Application And DENR Review
 - ARSD 74:36:20:05 requires that GCC demonstrate the modification to an existing source will not prevent or interfere with the attainment or maintenance of an applicable national ambient air quality standard. Since the AF project does not result in a significant net emission increase of any regulated NSR pollutant, the Facility will not result in an ambient air quality standard to be exceeded.
 - o In accordance with ARSD 74:36:20:07, GCC must include the following information listed in Table 7-1 in a construction application in order for DENR to deem the application complete.

Table 7-1: Complete Application Requirements

Requirement	Location in the Application
General Company Information:	Appendix A
Company Name and Address	
Owners Name and Address	
Plant Site Manager	
Description of the Plant, Processes, and Products	Section 2
Emissions Information:	Section 3, 4, 5, 6
Identification/Description of all emission units	
Fuels, fuel use, raw materials, and production rates	
Identification/Description of air pollution control	
equipment	
Limitations on Source Operation Affecting Emissions or	
any work practice standards, as applicable	
Other information required by any applicable	
requirements (e.g., stack height, emission unit locations,	
flow rates, building dimensions, stack parameters)	
Copy of Prepared Plans and Equipment Specifications	N/A
Signed and notarized certification of applicant form	Appendix A
Air Dispersion Modeling Results, as applicable	N/A
Stack Test Performance Testing Results, as applicable	N/A

o DENR will notify GCC within 30 days after submission of the application whether or not the application is complete. If DENR does not notify GCC within 30 days, the application will automatically be deemed complete. Additionally, DENR shall issue or deny the construction permit application within 180 days after deeming the application complete.

> Public Review

ARSD 74:36:20:11 states that DENR will provide GCC with a draft permit. In addition, public
notice of the draft permit will be published in a legal newspaper in the county where the source
is located. DENR must provide a 30-day notice for any hearing to contest a draft permit, if
requested.

> ARSD 74:36:21 - Regional Haze Program

- O ARSD 74:36:21 applies to the owner or operator of a new major source, modification to a major source, and a BART-eligible source. New sources or major modifications to existing sources that are subject to PSD permitting requirements or Non-Attainment NSR are not subject to the regional haze program. As described in Section 6, the AF project is not subject to PSD permitting or Non-Attainment NSR. As such, further applicability to the regional haze program needs to be assessed.
- As cited in ARSD 74:36:21:04, the owner or operator of a new major source or modification to a major source shall demonstrate to the DENR that the potential to emit from the new major source or modification to a major source will not adversely impact the visibility in any mandatory Class I federal area. The Facility is a major source and will be modified as a result of the AF project. As such, GCC is required to demonstrate that the AF project will not contribute to the adverse impact on visibility in any mandatory Class I federal area. Currently permitted PTE levels of dry kilns either remain unchanged or decreases. As a part of the regional haze rule development, DENR performed extensive visibility modeling of the Facility and concluded the visibility would not be adversely impacted at a Class I federal area as a result of emissions from the facility. This determination still holds following completion of the AF project.
- O Per ARSD 74:26:21:10, DENR can issue a PTC in accordance with ARSD 74:36:20 if it is determined that the modification to the major source does not contribute to adverse visibility impacts at a mandatory Class I federal area. As this application demonstrates, the AF project will not contribute to adverse visibility impacts at a mandatory Class I federal area

Fuel Processing and Storage

The proposed AFs will be received, stored, and managed under DENR's Solid Waste Permitting Program. The permit application is in the process of being prepared. GCC will amend the Facility's existing solid waste (SW) permit 11-12 to include approximately 60,000 tons of alternative fuels. Dacotah currently manages 60,000 tons per year of clinker kiln dust (CKD). Therefore, the facility would manage approximately 120,000 tons per year of solid waste. Per ARSD 74:27:08:02, SW permit 11-12 would remain a Type IIA facility permit, which allows for 25,000 – 150,000 tons annually. GCC will comply with the regulations cited in ARSD 74:27 listed below to amend the facility's SW permit.

ARSD 74:27:08 – Solid Waste Permit Procedures

- o Per ARSD 74:27:08:10, an application to amend a permit for a facility expansion must be submitted to the secretary within 180 days before the proposed date on which construction for the expansion is to begin. All other applications to amend a permit must be submitted at least 90 days before changes are implemented. GCC will submit a timely and complete permit amendment application for SW permit 11-12. DENR will notify GCC within 90 days after submission of the application whether or not the application is complete.
- > ARSD 74:27:09 Solid Waste Permit Applications
 - ARSD 74:27:09 lists the following requirements for a complete permit application:
 - Signature of an authorized agent for a corporation, a principal executive officer of at least the level of vice president.
 - Submit 3 copies of the application to the secretary, file one copy with the county commission, and file one copy with the municipality nearest to the facility.
 - Provide general information as required by ARSD 74:27:09:03(1) including contact information, facility location, facility category, anticipated operation / construction dates, types and characteristics of waste handled, etc.
 - Provide design and construction details as required by ARSD 74:27:09:03(2) including design methods, data, calculations, descriptions addressing sources, types, and amounts of solid waste received and handled over the life of the facility.
 - Provide maps as required by ARSD 74:27:09:03(3) including USGS topographical map, area map, groundwater contour map, and site characterization map required by ARSD 74:27:12:03.
 - Provide operational information required by ARSD 74:27:09:03(4) including an operational plan addressing requirements in ARSD 74:27:13, a copy of the recordkeeping log, a copy of the contingency plan, description of waste screening methods, description of personnel training plan, and miscellaneous information.
 - Provide closure / postclosure plans required by ARSD 74:27:15.
 - Provide financial assurance information required by ARSD 74:27:16.
 - Provide groundwater monitoring information required by ARSD 74:27:19.

GCC will submit a separate, complete solid waste permit amendment application, containing all the requirements listed in ARSD 74:27:09 to the DENR Solid Waste Bureau. In addition, GCC will notify the Pennington County as well as the Rapid City Fire Department of the proposed utilization of AFs at the facility. The majority of the processing and storage associated with the proposed AFs will occur offsite. Should this change, GCC will submit the new or revised DENR miscellaneous process operation forms for fuel handling. Any emissions resulting from these activities would most likely be negligible to minimal.

8. PROPOSED ALTERNATIVE FUEL PERMIT CONDITION

GCC is proposing that any alternative traditional fuels (Category 1), AFs with categorical exemptions under the NHSM Rule (Category 2), and AFs that have previously been EPA approved via comfort letters (Category 3) be permitted for use in the Facility's kiln. In regards to Category AFs, GCC will seek a formal determination from the U.S. EPA. To allow for the use of AFs that will be approved by U.S. EPA, GCC is proposing that the following permit condition be included:

The permittee shall not utilize alternative fuels that could cause the cement kiln system to meet the definition of a Commercial and Industrial Solid Waste Incineration (CISWI) as defined in 40 CFR 60.2875. The permittee shall maintain records in accordance with 40 CFR 60.2470(u) documenting that the alternative fuel is not a solid waste. The facility will make a self-determination whether the alternative fuel in question meets the federal non-waste criteria.

Or

The permittee shall be allowed to combust only non-solid waste non-hazardous secondary materials (NHSM) as defined in 40 CFR 60.2470(u) documenting that the NHSM is not a solid waste. The facility will make a self-determination whether the alternative fuel in question meets the federal non-waste criteria.



GCC Dacotah, Inc. 501 N. St Onge St Rapid City, SD 57709 Check Number Check Date Stub 0000000235 12/28/2017 1 of 1

Payee: DEPT OF ENV & NATURAL RESOUR

523 E. CAPITOL AVE PIERRE SD 57501-3181

Date of Inv	Doc Number	Your Invoice No	Text	Discount	Net Amount
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GCC Dacotah, Inc. 501 N. St Onge St Rapid City, SD 57709

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Pay to the order of: DEPT OF ENV & NATURAL RESOURCES 523 E. CAPITOL AVE PIERRE SD 57501-3181

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Application Form Air Quality Construction Permit

General Information Form And Certification of Applicant Form

SEND ALL MATERIALS TO:

SD Department of Environment and Natural Resources Air Quality Program 523 East Capitol Pierre, South Dakota 57501-3181

(Please complete shaded areas - if you have questions call (605) 773-3151)

A. Application Type

New 1

X

Check the appropriate box:

For administrative revisions,	provide existing permit number:
under the Title V air qua addition, a "Modification	ew" air quality construction permit that is also a major source of air emissions lity operating permit program is required to submit an application fee of \$125. It is an existing source with a Title V air quality operating permit is also require fee of \$125. The application fee is not applicable to ethanol plants.
B. General Information	
1. Facility name:	GCC Dacotah
2. Mailing address:	PO Box 360
City, state, zip code	Rapid City, SD, 57709
3. Facility location (if plant i	s portable, enter location at time of submittal):
Street and city	501 North Saint Onge Street, Rapid City
Legal description (if street ac	dress is unknown)
	(Quarter, Section, Township, Range)
4. Construction contact:	
Name/title	Jim Anderson
Telephone number	605-721-7033
Email address	janderson@gcc.com

Modification 1

Administrative Revision

Name/title Telephone number Email address				
Email address				
6. Responsible official:				
Name/title	Stephen J. Pos	t		
Telephone number	605-721-7100			
Email address	spost@gcc.co	n		
Note: A responsible of corporation; general pranking	artner or the pro	as a president, vice p prietor for a partner or municipal, state, f	ship; and principa	l executive officer or
7. Standard Industrial Clas	ssification Code (SIC code):		
Primary SIC code:	3241	Secondary SIC co	ode (if applicable):	
Please contact ti	ne Department a	(605) 773-3151 for as	sistance it bic cou	te is unknown.
See Attached Documents				

D. Air Emissions Summary (skip this section for Administrative Revisions)

Potential air emissions are calculated assuming the permitted unit operates 24 hours per day, 7 days per week, 52 weeks per year at its maximum design capacity. If air emissions are available, please complete the following table. Attach all available documentation used to calculate the potential air emissions such as a spreadsheet, software programs (i.e., Tanks 4.09), emission factors, calculations, MSDS sheets for all products containing volatile organic compounds and/or hazardous air pollutants, and other supporting documentation.

	Actual	Potential Controlled	Potential Uncontrolled
Pollutant	(tons per year)	(tons per year)	(tons per year)
PM10 ²			
PM2.5 ³			
Sulfur Dioxide			
Nitrogen Oxide			
Carbon Monoxide			
Volatile Organic Compounds			
Greenhouse Gases	LE THE T		
Hazardous Air Pollutants (if app	olicable)		

² - PM10 means particulate matter 10 microns in diameter or less; and

Please contact the Department at (605) 773-3151 if assistance is needed for calculating emissions for the permitted units such as emission factors, clarifying what potential emissions are, efficiency for control equipment, or for any other questions.

E. Forms for Specific Equipment and Control Equipment

9. The following forms must be completed for each piece of specific equipment being installed at the facility and submitted with this form:

Boiler, Turbine, or Furnace	Generators and Fire Pumps	Incinerator
Kiln or Dryer	Spray Booth	Storage Tank
Miscellaneous	Insignificant Activities 4	

⁴ - The "Insignificant Activities" form should be completed for each operation identified as an insignificant activity and exempt from permitting.

³ - PM2.5 means particulate matter 2.5 microns in diameter or less.

10. The following forms must be completed for each piece of specific air control equipment being installed at the facility and submitted with this form:

Baghouse	Cyclone	Electrostatic Precipitator
Thermal Oxidizer	Wet Scrubber	Miscellaneous

F. Certification of Compliance

I certify the following:

This application is submitted in accordance with the provisions of the South Dakota Codified Laws 34A-1 and Administrative Rules of South Dakota 74:36. To the best of my knowledge, after reasonable inquiry, the statements and information contained in the application and supporting documents are true, accurate, and complete. In accordance with South Dakota Codified Laws 1-40-27, I have also enclosed a completed Certification of Applicant form.

Signature:

Print Name:

Stephen J. Post
Responsible Official

12-28-17

Date

STATE OF SOUTH DAKOTA

BEFORE THE SECRETARY OF

THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IN THE MATTER OF THE) the second of
APPLICATION OF)
) CERTIFICATION OF
GCC Dacotah)
) APPLICANT
STATE OF South Dakota)
)
COUNTY OF Pennington)
I, Stephen J. Post, the applicant in the above matt	er after being duly sworn upon oath
hereby certify the following information in regard to this ar	oplication:

I have read and understand South Dakota Codified Law Section 1-40-27 which provides:

"The secretary may reject an application for any permit filed pursuant to Titles 34A or 45, including any application by any concentrated swine feeding operation for authorization to operate under a general permit, upon making a specific finding that:

- (1) The applicant is unsuited or unqualified to perform the obligations of a permit holder based upon a finding that the applicant, any officer, director, partner, or resident general manager of the facility for which application has been made:
 - (a) Has intentionally misrepresented a material fact in applying for a permit;
 - (b) Has been convicted of a felony or other crime involving moral turpitude;
 - (c) Has habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage;
 - (d) Has had any permit revoked under the environmental laws of any state or the United States; or
 - (e) Has otherwise demonstrated through clear and convincing evidence of previous actions that the applicant lacks the necessary good character and competency to reliably carry out the obligations imposed by law upon the permit holder; or
- (2) The application substantially duplicates an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Nothing in this subdivision may be construed to prohibit an applicant from submitting a new application for a permit previously denied, if the new application represents a good faith attempt by the applicant to correct the deficiencies that served as the basis for the denial in the original application.

All applications filed pursuant to Titles 34A and 45 shall include a certification, sworn to under oath and signed by the applicant, that he is not disqualified by reason of this section from obtaining a permit. In the absence of evidence to the contrary, that certification shall constitute a prima facie showing of the suitability and qualification of the applicant. If at any point in the application review, recommendation or hearing process, the secretary finds the applicant has intentionally made any material misrepresentation of fact in regard to this certification, consideration of the application

may be suspended and the application may be rejected as provided for under this section.

Applications rejected pursuant to this section constitute final agency action upon that application and may be appealed to circuit court as provided for under chapter 1-26."

I certify pursuant to 1-40-27, that as an applicant, officer, director, partner, or resident general manager of the activity or facility for which the application has been made that I; a) have not intentionally misrepresented a material fact in applying for a permit; b) have not been convicted of a felony or other crime of moral turpitude; c) have not habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage; (d) have not had any permit revoked under the environmental laws of any state or the United States; or e) have not otherwise demonstrated through clear and convincing evidence of previous actions that I lack the necessary good character and competency to reliably carry out the obligations imposed by law upon me. I also certify that this application does not substantially duplicate an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Further;

"I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct."

Dated this 28 day of December ,2017.

Stephen J. Post
Applicant (print)

Applicant (signature)

Subscribed and sworn before me this 28 day of December ,2017.

Notary Public (signature)

My commission expires: October 3, 2023 SEAL

(SEAL)

PLEASE ATTACH ANY ADDITIONAL INFORMATION NECESSARY TO DISCLOSE ALL FACTS AND DOCUMENTS PERTAINING TO SDCL 1-40-27 (1) (a) THROUGH (e).

ALL VIOLATIONS MUST BE DISCLOSED, BUT WILL NOT AUTOMATICALLY RESULT IN THE REJECTION OF AN APPLICATION

APPENDIX B: 05/08/2013 EPA RESPONSE TO VEXOR TECHNOLOGY REGARDING ENGINEERED FUEL FROM INDUSTRIAL SOURCES



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WASHINGTON, D.C. 20460

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE

MAY - 8 2013

Patrick Oberth
Facility, Technical and Compliance Manager
VEXOR Technology
955 West Smith Road
Medina, OH 44256

Dear Mr. Oberth:

In your letter of March 14, 2013, you requested confirmation from the U.S. Environmental Protection Agency (EPA) that VEXOR Engineered Fuel® (VEF), which you produce by processing specific non-hazardous secondary materials (NHSM), will be considered a non-waste fuel when burned for energy recovery in combustion units in accordance with the requirements of 40 CFR 241.3(b)(4).

To be designated as a non-waste fuel under that section (40 CFR 241.3(b)(4)), the regulations require that the following conditions are met:

A. Processing

The discarded NHSM undergoes processing as defined in 40 CFR 241.2 to transform the material into a product fuel.

B. Legitimacy criteria

The processed NHSM must meet the legitimacy criteria for fuels in 40 CFR 241.3(d)(1). The legitimacy criteria are meant to show that the material is indeed a useful product and is not being burned to destroy or dispose of the NHSM (or the contaminants) as a waste.

Based on the information provided in your March 14, 2013, letter (and a supporting statement), we believe the VEF—which you produce from processing of industrial and commercial NHSMs, and ReEngineered Feedstock²—is a non-waste fuel when burned in combustion units as

¹ This request for a letter from EPA regarding the regulatory status of the engineered fuel produced by VEXOR Technology supersedes your previous request (as discussed in your October 2011 letter to EPA and other supporting information).

² ReEngineered Feedstock is a product fuel developed by ReCommunity Inc. and made from non-recyclable materials from commercial, industrial, and institutional waste streams. The Agency previously determined that ReEngineered Feedstock is a non-waste fuel. See

http://www.epa.gov/osw/nonhaz/define/pdfs/ReCommunityLetterAugust24.pdf. VEXOR Technology includes the ReCommunity product in its process along with other material.

described in your letter. The remainder of this letter provides the basis for our position. If there is a discrepancy in the information provided to us, it could result in a different interpretation.

We understand that VEXOR Technology currently operates several facilities that develop VEF product fuel for use as an alternative to coal. VEXOR Technology takes specific NHSMs from industrial and commercial sources, and ReEngineered Feedstock, then processes the materials into combustor-specific fuel products (as described in Section A below). The manufactured product fuels are understood to have commercial applications in coal-burning combustion units, such as cement kilns, lime kilns, and utility boilers.

A. Processing

Processing is defined in 40 CFR 241.2 as operations that transform discarded NHSM into a non-waste fuel or non-waste ingredient, including operations necessary to: remove or destroy contaminants; significantly improve the fuel characteristics (e.g., sizing or drying of the material in combination with other operations); chemically improve the as-fired energy content; or improve the ingredient characteristics. Minimal operations that result only in modifying the size of the material by shredding do not constitute processing for the purposes of the definition.

The determination of whether a particular operation or set of operations constitutes sufficient processing to meet the definition in 40 CFR 241.2 is necessarily a case-specific and fact-specific determination. This determination applies the regulatory definition of processing to the specific discarded material(s) being processed, as described in your March 14, 2013 letter (and supporting statement) taking into account the nature and content of the discarded material, as well as the types and extent of the operations performed on it. Thus, the same operations may or may not constitute sufficient processing under the regulation in a particular circumstance, depending on the material being processed and the specific facts of the processing. In some cases, certain operations will be sufficient to "transform discarded non-hazardous secondary material into a non-waste fuel[,]" and in other cases, the same operations may not be sufficient to do so.

In general, we understand that your process includes source control for specific requested components that have certain fuel characteristics (for example, companies provide you with clean diaper tailings from the manufacture of diapers, for addition as an adsorbent), characterization of each component's combustion properties, contaminant removal, fuel amendments, blending based on combustor-specific recipes, and analysis to ensure it meets combustor-specific requirements. In your letter, you state that the processing of NHSMs into VEF product fuel involves the following steps and operations:

³ A non-waste determination under 40 CFR part 241 does not preempt a state's authority to regulate a non-hazardous secondary material as a solid waste. Non-hazardous secondary materials may be regulated simultaneously as a solid waste by the state, but as a non-waste fuel under 40 CFR Part 241 for the purposes of determining the applicable emissions standards under the Clean Air Act for the combustion unit in which it is used.

Page 3 of 9

1. Selection of Suitable Feedstock Components

You indicate that the source controls employed at commercial/industrial sites are central to the VEF processing operation, selecting components with desirable fuel characteristics and prohibiting components with unacceptable fuel characteristics (i.e., low Btu and/or contaminant-bearing components).

Specifically, you explain that the NHSMs you process into VEF are select components from commercial and industrial sources, blended with ReEngineered Feedstock.

The commercial and industrial NHSMs⁴ that you process to produce VEF are segregated at the source before shipment to your processing facility. These materials include paper bags, oily or waxy cardboard, coated plastics (halogen free), carbon-black (e.g., from the production of tire rubber), oils,⁵ resins, soy-based inks, polyols, waxes, and absorbents (sawdust, paper, cardboard, and diaper tailings). Each of these NHSMs either enhances the Btu value or improves the fuel characteristics, and each batch of VEF is produced to meet an end user's (combustor's) specifications.

2. Management and Evaluation of Selected Feedstocks

You indicate that VEXOR Technology only accepts industrial and commercial NHSMs that have been pre-approved in accordance with analysis plans approved by state authorities. Under the analysis plans, each potential NHSM is characterized and evaluated to determine if it can be used as input in producing VEF. The evaluation of contaminant levels, heating value, and other requirements are tailored to individual product specifications. While some VEF product formulations have different limits based on customer specifications, all limits are within acceptable ranges as described in the Comparability of Contaminant discussion below. VEXOR Technology does not accept any hazardous wastes.

All inbound containers are sampled and tested, following an approved process for fingerprint analysis (identification of presence and source of contaminants) to ensure the incoming NHSM matches the pre-approved material. Materials not acceptable are disposed of by VEXOR Technology or returned to the generator for proper processing or disposal. For example, materials found to have high levels of chlorine, sulfur, fluorine, or metals are rejected and sent back to the generator.

⁴ You stated that you do not consider any of the NHSMs that you get from the industrial/commercial sites as a municipal solid waste. In addition, you have stated that the select feedstocks [NHSMs] are not part of the industrial/commercial sites' regular trash.

The March 14 letter stated "Oils are tested to ensure they are not mixed with halogenated solvents via the initial approval, test kits and outside lab analysis. If halogens are detected and a rebuttal is not offered, these are rejected back to the generator or to an alternate facility for proper disposal. Oils with high levels of rebuttable halogens are not included in the VEF due to the low halogen specification of the fuel." Such procedures are used to ensure the oil is not a hazardous waste in accordance with the 40 CFR Part 279 standards for management of used oil.

3. Development of Recipe to Meet Combustor-Specific Requirements

In addition to pre-approval procedures and testing of all incoming NHSMs, you emphasized that you employ rigorous procedures for the selection of specific components to achieve the specifications for the end user kiln (or other combustor) based on parameter testing, including heating value, ash content, sulfur, and mercury among others necessary for specific kiln operations and air emissions. VEXOR Technology also explained, and provided information on the rigorous proprietary procedures used when selecting and tracking the components it uses to meet these requirements.

The components that are selected for the recipe are further examined. Contaminants that were not identified in the initial assessment are removed, including metals, inorganic materials, and other contaminants not able to support combustion or, if used in a cement or lime kiln, are not beneficial to the product being produced. For example, a batch of NHSM is assessed and if a component of the material is found that is not acceptable (e.g., a brake pad), it is mechanically separated from the remainder of the NHSM using a track hoe and removed by an operator.

Based on your description, we understand that this process results in recipes that are tailored to the individual specifications contractually agreed to by VEXOR Technology and its customers (regarding heating value and other specifications). For example, you indicate that a utility boiler would have different specifications than cement or lime kilns since the cement or lime kiln may need certain compounds or chemicals that may be deficient in their raw material or coal that is vital to the chemical makeup of the product they are producing, i.e., cement or lime.

4. Blending and Processing Selected Feedstocks to the Desired Recipe

Mixing and processing recipes are followed to achieve a specification-driven fuel with reduced particle size that ensures complete combustion in the firing zone. The evaluation of contaminant levels, heating value, and other requirements are tailored to the specifications contractually agreed to by individual customers of VEXOR Technology.

Prior to final processing, addition of specific materials for the desired recipe can include NHSMs to enhance combustion based on QA/QC testing. For example, carbon black and non-halogenated oils are added, if needed, to increase the heating value. Absorbents are also added, if needed, at this stage or earlier in the process. The absorbents used include paper, cardboard, diaper tailings, and sawdust.

Once the selected NHSMs are mixed and blended, the blended material is then processed via an operation utilizing shredders fed by conveyor systems with head magnets and

⁶ Ferrous metals are removed at three stages in the process with large magnets.

overhead magnets used to remove metal contamination. Large pieces of NHSMs that do not have heating value are removed prior to mixing and during the conveyor feeding process via a visual sorting and hand removal process. The initial shredder reduces the particle size to assist in proper mixing and blending and the associated conveyor with head magnet removes coarse metals. The second shredder further reduces particle size and feeds to the final shredder via conveyors with overhead magnets and head magnets. These remove any metals that remain. The final shredder takes the blended material to a two dimensional particle size of less than 30mm.

Overall, a homogenous material is ensured by pre-approval of the NHSMs used to produce the VEF product fuel, analyses performed on the incoming NHSMs, and strict adherence to the recipe to produce a product fuel that meets the customers specifications. Mixing and shredding of the NHSMs helps ensure a product fuel with a uniform chemical makeup and combustion characterization.

5. Analysis of the VEF Product

Testing is conducted during and after mixing, as well as after particle size reduction, to ensure the VEF product fuel adheres to strict specifications for combustion and performance in the combustion unit (including testing for contaminants). The testing is done on a composite sample of the process batch. The quality controlled products meeting individual specifications are then delivered to the customer. You state that the specifications vary by customer; however, you have indicated that the contaminant specifications provided by VEXOR Technology are the maximum levels that will be in any VEF product fuel.

Based on this description and evaluation of your processing activities, we believe your operations meet the definition of processing in 40 CFR 241.2, and the NHSMs from the commercial and industrial sources are transformed into a product fuel. In particular, this determination is based on the following operations employed by VEXOR Technology: (1) The prevention/removal of contaminants is achieved by limiting contaminants via source control, removing the ferrous metals in three stages, and isolating and removing other materials/components that would contribute to contaminants, and tesing of the final VEF fuel product; (2) The improvement of the fuel characteristics is achieved by source control, particle size reduction through shredding, precise blending to meet the customer's combustion criteria and by creation of a fuel product that is homogenous within each batch promoting even and controlled combustion; and (3) The chemical improvement to the as-fired energy content is achieved, as required, by adding absorbents and other inputs with high energy content, such as non-halogenated oils and carbon black.

The agency notes that the processing operations, as described, help ensure the creation of fuel products with predictable fuel qualities, regardless of the varied inputs into the process. Furthermore, testing of the final VEF product fuel helps ensure that it meets both VEXOR's specifications and the contaminant legitimacy criteria.

B. Legitimacy Criteria

Under 40 CFR 241.3(d)(1), the legitimacy criteria for fuels include:

- management of the material as a valuable commodity based on the following factors—storage prior to use must not exceed reasonable time frames, and management of the material must be in a manner consistent with an analogous fuel, or where there is no analogous fuel, adequately contained to prevent releases to the environment;
- 2) the material must have meaningful heating value and be used as a fuel in a combustion unit that recovers energy; and
- 3) the material must contain contaminants at levels comparable to or less than those in traditional fuels which the combustion unit is designed to burn.

1. Managed as a Valuable Commodity

Regarding the first criterion, your letter states that the VEF product fuel is managed as a valuable commodity by both VEXOR Technology and by the end user. In general, you state that "VEF is a commodity, purchased as a fuel for use as a fuel in a manufacturing process." You also provided specific details. Specifically, VEF product fuel is stored at VEXOR Technology's processing site in covered storage areas, until the amount accumulated is sufficient for a week of burn time when delivered to the customer. Customers purchase VEF product fuel as a supplement to coal and typically have a working storage capacity of 3-7 days of burn time. Your letter also states that the storage time is shorter than for traditional coal pile storage at a combustion unit, where coal is said to be stored on-site for months prior to use. The use of the VEF product fuel requires additional capital and equipment for the combustor to properly store in a covered area, convey, and burn the VEF product fuel. Covered storage prevents releases to the environment and helps ensure the fuel stays dry and continues to meet product specifications.

Based on this information, we agree that the VEF product fuel is "managed as a valuable commodity," per 40 CFR 241.3(d)(1)(i)(A) and as discussed in the NHSM final rule. Please note that the facilities receiving the material must also manage it as a valuable commodity for the material to remain a non-waste fuel when combusted.

⁷ In the NHSM final rule (76 FR 15520) "reasonable time frame" is not specifically defined as such time frames vary among the large number of non-hazardous secondary materials and industry involved.

Page 7 of 9

2. Meaningful Heating Value and Used as a Fuel to Recover Energy

Regarding the second legitimacy criterion, you state that the heating value for the VEF product fuel ranges an as-fired heating value between 6,000 and 13,000 Btu/pound. The specification of heating value is modified for each customer based on the product fuel being produced. As an example, you indicated that VEF product fuel destined for the hot zone of a lime kiln would be engineered to have a heating value of roughly 10,000 Btu/lb, whereas VEF product fuel destined for a pre-calciner cement kiln could be engineered to have a heating value as low as 6,000 Btu/lb. As the Agency stated in the preamble to the NHSM final rule, NHSMs with an energy value greater than 5,000 Btu/lb, as fired, is considered to have a meaningful heating value (see 76 FR 15541, March 21, 2011). Thus, since the VEF product fuel has a heating value greater than the 5,000 Btu/lb, the VEF product fuel meets the second legitimacy criterion.

3. Comparability of Contaminant Levels

Regarding the third legitimacy criterion, we have prepared the enclosed table "Comparison of VEXOR Engineered Fuel® to Coal" to compare the specifications and analytical data you submitted for your VEF product fuel to data for coal from our "Contaminant Concentrations in Traditional Fuels: Tables for Comparison" document. For all contaminants, VEF specifications are within the range of contaminant levels found in coal. Additionally, the tests provided demonstrate that the VEF product fuel can be produced within the VEF product fuel specifications. Accordingly, VEF meets the contaminant legitimacy criterion when compared to coal (we understand that VEF is designed as a replacement to coal and would be sold to units that are also designed to burn coal).

This conclusion assumes that the product was tested for any contaminant that would be expected to be present. Additional contaminants for which VEF product fuel was not tested must, as is the case for those tested, be present at levels comparable to or lower than those in coal, based on your knowledge of the material. Since VEXOR Technology plans to use different mixes of approved components to meet customer product specifications for different fuel products, our determination is contingent upon VEXOR Technology's plan to continue to meet the contaminant specifications listed in the enclosed chart "Comparison of VEXOR Engineered Fuel® to Coal." The analysis comparing product specifications to traditional fuel contaminant levels demonstrates that the VEF product fuel can be produced within those specifications.

⁸ Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011 can be found at www.epa.gov/epawaste/nonhaz/define/index.htm.

Page 8 of 9

C. Conclusion

Overall, based on the information provided, we believe that VEXOR Technology's VEF product fuel, as described in your letter and supporting statement, meets both the processing definition and the legitimacy criteria outlined above. Accordingly, we would consider this material a non-waste fuel.

If you have any other questions, please contact Tab Tesnau of my staff at 703-605-0636.

Sincerely,

Betsy Devlin, Director

Materials Recovery and Waste Management Division

Enclosure

Enclosure

Comparison of VEXOR Engineered Fuel® to Coal

Contaminant	Unitsa	VEXOR Engineered Fuel® (VEF) Specifications ^b (and test results for Mn and Se)	Coal ^c	Result of Comparison to Specifications and to Analytical Test Results
Metal elements -	Dry basis			
Antimony (Sb)	ppm	< 6.8	ND - 10	Within the range of coal
Arsenic (As)	ppm	< 5	ND - 174	Within the range of coal
Beryllium (Be)	ppm	< 5	ND - 206	Within the range of coal
Cadmium (Cd)	ppm	< 2	ND - 19	Within the range of coal
Chromium (Cr)	ppm	< 20	ND - 168	Within the range of coal
Cobalt (Co)	ppm	< 20	ND - 30	Within the range of coal
Lead (Pb)	ppm	< 25	ND - 148	Within the range of coal
Manganese (Mn)	ppm	Test Result 1.01-17.13 ^e	ND - 512	Tests results are within the range of coal
Mercury (Hg)	ppm	< 2	ND - 3.1	Within the range of coal
Nickel (Ni)	ppm	< 100	ND - 730	Within the range of coal
Selenium (Se)	ppm	Test Result 0.00-2.67 ^e	ND - 74.3	Tests results are within the range of coal
Non-metal eleme	nts - dry t	pasis		
Chlorine (Cl)	ppm	< 5,000 (0.5%)	ND - 9,080	Within the range of coal
Fluorine (F)d	ppm	0	ND - 178	Within the range of coal
Nitrogen (N)	ppm	< 35,000 (3.5%)	13,600 - 54,000	Within the range of coal
Sulfur (S)	ppm	< 10,000 (1.0%)	740 - 61,300	Within the range of coal
Notes:				

^a All contaminant analyses—VEF and coal—are on a dry weight basis. ^b Contaminant data sent from Vexor Technology 3-4-13.

^c Coal data taken from EPA document *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011,* available at www.epa.gov/epawaste/nonhaz/define/index.htm. Refer to that document for the footnotes and sources of the data.

d The specification value for fluorine is listed as "0."

Specifications for Manganese and Selenium were not provided, but the levels in test results provided were well within the range in coal.

APPENDIX C: PROJECTED ACTUAL AND BASELINE ACTUAL EMISSION CALCULATIONS

Appendix C - Projected Actual and Baseline Actual Emission Calculations

#	Month of Baseline Period	Clinker Production (ton/month)	CO Emissions (lb/month)	CO Factor (lb/ton)	Monthly CHA Production (ton/month)
1	April-14	41,508	162,652	3.92	17827
2	May-14	57,776	225,166	3.90	1559
3	June-14	52,397	208,648	3.98	6938
4	July-14	61,007	256,245	4.20	-1672
5	August-14	62,030	241,460	3.89	-2695
6	September-14	58,488	268,038	4.58	847
7	October-14	54,880	214,779	3.91	4455
8	November-14	60,085	189,751	3.16	-750
9	December-14	58,593	146,962	2,51	742
10	January-15	58,040	171,757	2.96	1295
11	February-15	6,981	8,409	1.20	52354
12	March-15	48,919	139,387	2,85	10416
13	April-15	54,173	145,012	2.68	5162
14	May-15	65,826	168,271	2.56	-6491
15	June-15	58,728	161,331	2.75	607
16	July-15	50,415	131,693	2.61	8920
17	August-15	63,097	216,281	3.43	-3762
18	September-15	63,944	211,151	3.30	-4609
19	October-15	68,868	155,075	2.25	-9533
20	November-15	50,314	117,541	2,34	9021
21	December-15	67,749	194,704	2.87	-8414
22	January-16	64,692	266,735	4.12	-5357
23	February-16	59,838	160,673	2.69	-502
24	March-16	68,214	157,097	2.30	-8879
	Monthly Average	56,523	179,951		
	Yearly Average	678,281	2,159,408		
	Monthly Max	68,868	268,038		

Clinker Calculations:

Klin Clinker Permit Throughput Limit (tpy)	Haseline Yearly Average Throughput (tpy)	Kiln Clinker Avg Throughput (tons / month)	Max Historical Clinker Prud (tons / month)	is Demand Growth Historically Present?
1,204,500	678,281	56,523	59,335	Yes

CO Emission Calculations:

Historical Max 24 Month Rolling Clinker Production (tons / month)	BAE + CHA Clinker Production during Baseline Period (tpy)	Exceeded Permit Limit?			
59,335	712,020	No			
Kiln CO PAE Emission from Kiln 6 Upgrade Project (tpy)	The second secon	BAE CO Emissions (tpy)	BAE CO Emission Factor (lb/ton)	CHA CO Emissions (tpy)	CHA + BAE CO Emissions (tpy)
1,174.39	33,740	1079.7	3.18	53.7	1,133.41

In calculating CHA, production could meet the maximum historical 24-month rolling clinker production (tpy) (from Mar 2016 - Feb 2017) if demand growth was present.

PAE Emission Calcuations

PAE Kiln CO Emissions (tpy)	Anticipated Change in	PAE CO Emission	Anticipated Change in
	Emissions (tpy)	Factor (lb/ton)	Emissions (tpy)
1,229.8	8.5%	3,45	96

The projected actual clinker production is unchanged from the BAE + CHA clinker production.

Month	Clinker Production tons/month	12-Month Rolling Average Clinker Production tons/year	Stack CO Emission lbs/month	24-Month Rolling Average CO Emissions tons / year
January-11	0		0	
February-11	36895		58340	
March-11	\$8510.27006		104180	
April-11	57954.7619		101807	
May-11	56568.16027		84647	
June-11	55487.49008		80232	
July-11	62390.89065		88845	
August-11	61072.73258	Single and the second	76987	
September-11	41755:0496		51163	
October-11	\$2740.31966		74015.9	
November-11	56930.70106		85828.8	
December-11	59385.70216		82203.2	
January-12	18302.33686		27029.9	
February-12	54776.32275		95393.4	
March-12	60611.78351		84991.1	
April-12	59098.78197		86843.4	
May-12	58977.77778		76342.3	
June-12	49169.05864		65884.8	
July-12	60003.35097		79281.8	
August-12	54982,78219		79870,2	
September-12	58013,30467		90308.7	
October-12	56643,67284		89416.5	
November-12	55447.63007		84599.8	
December-12	49186.84965		83303.9	457.878675
January-13	19556.70194			464.732875
February-13	51230.32407		i	
			ł	460.560675
March-13	58770.95459	634528.7202	1 BUD45./	
March-13 April-13	58770.95459 58337.08113		§	
April-13	58337.08113	634719.8799	97162.8	459.399625
April-13 May-13	58337.08113 60731.32716	634719.8799 636801.4633	97162.8 119988.6	459.399625 468.235025
April-13 May-13 June-13	58337.08113 60731.32716 56270.6239	634719.8799 636801.4633 637193.0302	97162.8 119988.6 92289	459.399625 468.235025 471.249275
April-13 May-13 June-13 July-13	58337.08113 60731.32716 56270.6239 58738.89991	634719.8799 636801.4633 637193.0302 635367.0348	97162.8 119988.6 92289 105794	459,399625 468,235025 471,249275 475,486525
April-13 May-13 June-13 July-13 August-13	58337.08113 60731.32716 56270.6239 58738.89991 54083.54277	634719.8799 636801.4633 637193.0302 635367.0348 631872.4399	97162.8 119988.6 92289 105794 97806.6	459.399625 468.235025 471.249275 475.486525 480.691425
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December-14	58592.55732	644017.6455	146961.5	814.7664
January-15	58039.92504	663259.2571	171757	850.85145
February-15	6980.919312	641134.5547	8409.2	836.652375
March-15	48918.9925	636208.5736	139387.2	851.34275
April-15	54173.14815	634126.6071	145012.2	863.3051
May-15	65826.17945	636674.0333	168270.6	875.3756
June-15	58728.33995	637902.8913	161331	892.6361
July-15	50414.84788	633740.8653	131692.7	899.110775
August-15	63096.62698	638247.4074	216280.6	928.729275
September-15	63943.57363	641841.2566	211151.1	956.415525
October-15	68867.68078	653661.9191	155075	981.730225
November-15	50313.9	650223.7357	117541	985.5622
December-15	67749	661230.3565	194704	1012.999175
January-16	64692.35373	664317.2741	266734.93	1064.109758
February-16	59837.50528	666816.1298	160673.06	1070.281048
March-16	68214.01587	678280.9332	157096.72	1079.704228
April-16	28324,63721	671689.1066	63400.2	1054.891278
May-16	74194.4	679898.3569	152108.5	1036.626903
June-16	64168.2	685783.8237	159650.89	1024.377675
July-16	66295.3	688427.8053	102726.28	985.997895
August-16	68431.5	691628.3839	101177.88	950.92729
September-16	63845.2	694306.7434	98725.1	908.599065
October-16	28553.2	681143.5065	55240.21	868.7144175
November-16	62410.4	682306.2015	107201.71	848.077145
December-16	57671.9	681845.8729	102340.89	836.9219925
January-17	66369.6	686010.7104	130410.06	826.5852575
February-17	59000.4	712020.4507	118322.85	854.06367
March-17	43847.7	709484.8045	103876.93	845.1861025
April-17	43950	704373.2304	116442.19	838.0436
May-17	65354.1	704137.1907	178351,56	840.56384
June-17	50963.9	700254.9707	111594.01	828.1295925
July-17	64600.4	707347.7467	138863.19	829.922215
August-17	69924.5	710761.6832	167198.97	817.6518075
September-17	38046.3	697813.0464	87210.74	786.6667175
October-17	59309.9	693034.156	159439.74	787.7579025
November-17	67247.7	701501.056	163201.66	799.1730675

	Months of Max Clinker Production (ton/month)		Baseline CO Emissions	Baseline Period
1st Max	74194	May-16	1079.7	March-16

Baseline Clinker Prod (24 month) (tpy)	Baseline Period
712020.5	February-17

APPENDIX D: SELF-CERTIFICATION DETAILS FOR SELECTED FUELS

As part of this permit application, GCC is providing self-certification details for several fuels that it would like to begin using at this facility as soon as possible, including:

- > Furniture fiber
- Mixed plastics
- > Vehicle fluff/Auto Shredder Residue (ASR)
- Wind Turbine Blade
- > Woody fiber

These details outline why GCC believes that they meet the definition of an NHSM based on how they are processed and satisfaction of the legitimacy criteria.

From: Faison, George

Sent: Monday, July 03, 2017 9:38 AM

To: Braaten, Bruce (MPCA)

Subject: Re: State Review of NHSM Determinations

Hi Bruce -

In your email below, you requested a clarification of the state's role in reviewing and approving self-determinations under the non-hazardous secondary material (NHSM) standards in 40 CFR 241.3(a) and (b).

As you know, CAA 129 states that the term "solid waste" shall have the meaning established by the Administrator under RCRA. Subtitle D of RCRA focuses on the management of non-hazardous solid waste, while the 40 CFR 241.3(a) and (b) standards promulgated under Subtitle D specifically identify whether or not an NHSM is a solid waste when used as a fuel or ingredient in a combustion unit.

The NHSM standards do not include federal approval procedures for state adoption of the rules under Subtitle D. Accordingly, states would not have delegated authority to review NHSM self-determinations nor provide state NHSM solid waste interpretations. We recommend, therefore, that MPCA and other state air programs coordinate with their designated EPA Regional solid waste contacts (or other established state air program- EPA coordination pathways) for assistance in reviewing NHSM waste/non-waste self-determinations under section 241.3(a) and (b).

We also note that CAA standards identify specific recordkeeping requirements for documenting NHSM non-waste determinations (40 CFR 63.7555(d)(2) for major source boilers; 40 CFR 63.11225 for area source boilers and 40 CFR 60.2175(v) and 40 CFR 60.2740(u) for commercial and industrial solid waste incinerations units). MPCA and other state air agencies responsible for implementing title V and/or the applicable CAA section 112 standard would have authority to require a facility to provide a copy of the NHSM self-determination. While implementation of the NHSM regulations is a federal responsibility, a state air agency could review the determination and refer it to the EPA if the review identified potential concerns with the facility's conclusions.

Sorry for the delay in responding to your question, and please let us know if we can be of further assistance.

George Faison
U.S. Environmental Protection Agency
OSWER, ORCR
1200 Pennsylvania Avenue, NW
Mail Code 5303P
Washington, DC 20460

Woody Fiber Fuel - NHSM Self-Certification Documentation

I. Introduction:

- A. This document shows that the Woody Fiber Fuel to be utilized as an alternative fuel by GCC meets the definition of Non-Hazardous Secondary Material (NHSM) fuel as described at 40 CFR 241. Woody Fiber Fuel may be referred to in other literature as woody biomass, wood waste, shredded wood scrap, wood byproducts, or other similar terms. The following sections describe Woody Fiber Fuel and how the material meets NHSM regulations as a non-waste fuel. The Process Description section contains a description of the cement manufacturing process, documents how the AF is used to replace fossil fuels, and the co-benefits of using AF from an environmental standpoint.
- B. The Woody Fiber Fuel received by GCC and used as fuel consists of wood or wood-like cellulosic material that has been selected, cleaned, processed and blended to make suitable fuel for use in GCC cement kilns. The Woody Fiber Fuel is essentially made up of woody biomass, but may contain small residual amounts of metal particles, dirt, glass, plastic, or paper.
 - Many of the component materials that make up The Woody Fiber Fuel can be readily
 identified as clean cellulosic biomass as described in the definition in 40 CFR §241.2
 Definitions. The purpose of this document is to show that The Woody Fiber Fuel is made up
 of materials that:
 - a. Are already specifically referenced in the definition of *Clean Cellulosic Biomoss* in 40 CFR §241.2 ("Clean Biomass"); or,
 - b. Bear strong chemical and physical similarities to the definition of clean cellulosic biomass but are not specifically referenced in 40 CFR §241.2 definition for Clean Cellulosic Biomass ("Biomass-Like"), and have not been discarded, meet the legitimacy criteria, and make a valuable contribution as a fuel for cement kilns; or,
 - Are already subject to a categorical exclusion or are chemically and physically indistinguishable from materials which are subject to a categorical exclusion ("Categorical Material"); or,
 - d. Have not been discarded, are sufficiently processed, meet the legitimacy criteria as further specified in this document for Woody Fiber Fuel, make a valuable contribution as a fuel for cement kilns but do not meet the exact definition criteria specified in a-c above. ("Legitimized Material").
 - 2. The Woody Fiber Fuel is derived from the processing of wood and wood-like materials from manufacturing byproducts, shipping materials, scrap material from utility companies, scrap material from commercial lumber companies, large-scale agriculture, trimmings from commercial and residential landscaping activities, and other activities where scrap wood has been isolated from other materials and is collected. "Wood-like material(s)," when referenced, means pine cones, acorns or other tree nuts, pecan shells, walnut shells or other tree nut shells, tree bark, and similar materials. Woody fiber may contain small residual quantities of leaves, pine needles, and grass or weed trimmings, although those materials

Woody Fiber Fuel - NHSM Self-Certification Documentation

are generally excluded during sorting, selection, and processing because of their higher potential moisture content.

- 3. Substantial quantities of materials that make up The Woody Fiber Fuel are generated in the manufacture of log homes, fence posts, structural timber, utility poles, shipping and packaging materials. Co-products from these manufacturing processes may be pelletized to make stove pellets, laminated to manufacture particle board or oriented-strand board, dyed to make landscape mulch, sold as an absorbent for livestock pen lining, generated into pulp to make paper or cardboard products, blended with other material to use as fuel, used to control nitrogen releases from farms, or used as compost.^{1,2,3,4,5}
- 4. Intermodal transportation, handling, and storage of goods and commodities generates significant quantities of wooden shipping pallets, crates, and separator boards. Pallets and similar materials are considered to be reusable but it is not always economically justified to return empty pallets for reuse. Repairing and shipping a used pallet often exceeds the cost of replacing it with a new one.⁶ Unused pallets, crates and shipping materials may be used in do-it-yourself projects, such as making shelves, or can be broken down by manufacturing companies to be used to repair other products.^{7,8} Shipping pallets, crates, and separator boards are commonly made of low-grade hardwood such as white oak or southern yellow pine.⁹ The wood most often used to construct shipping material tends to have low moisture content and high heat value by virtue of its age because of the nature of hardwoods.

¹Woodchuck, "Wood Manufacturing By-Products," Cal Cedar, last modified November 23, 2005, accessed April 1,2019, http://calcedar.com/wood-manufacturing-by-products/

² Franz Schmithüsen, "Entrepreneurship and Management in Forestry and Wood Processing," googlebooks, https://books.google.com/books?id=MyfLCQAAQBAJ&pg=PA60&lpg=PA60&dq=wood+product+manufacturing+coproducts&source=bl&ots=CufUKBSGVa&sig=ACfU3U2z6pJH-

Bhvt8UdPkAAypPKi6uTHg&hl=en&sa=X&ved=2ahUKEwix95b3q6_hAhUEXK0KHflwATEQ6AEwBHoECAgQAQ#v=one page&q=wood%20product%20manufacturing%20coproducts&f=false

³ Richard D. Bergman, "LIFE CYCLE INVENTORY OF MANUFACTURING PREFINISHED ENGINEERED WOOD FLOORING IN EASTERN US WITH COMPARSION TO SOLID STRIP WOOD FLOORING," Wood and Fiber Science, Published October 2011, accessed April 1,2019, https://www.fpl.fs.fed.us/documnts/pdf2011/fpl_2011_bergman003.pdf
⁴ Greb, Peggy, "Nixing Nitrogen Flow From the Farm," Agricultural Research, February, 2012, p. 18.

⁵ USEPA, Advancing Sustainable Materials Management: Facts and Figures Report, "Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States", July, 2018

⁶ Jonas Bengtsson, "Life cycle assessment of one-way and pooled pallet alternatives," ScienceDirect, Published 2015, accessed April 3,2019,

https://reader.elsevier.com/reader/sd/pii/S2212827115000852?token=50E8CBB1539EE0B1AD8BEB37E581779E27 7323E97FCD46041CB76CFC24DEF001F3A964CD7578354321CD8AF377CDB01C 7 lbid.

⁸Brandon, "10 Projects You Can Make With Scrap Wood," ManMade, last modified September 10, 2018, accessed April 1, 2019, https://www.manmadediy.com/scrap-wood-projects

⁹ Jonathan Haynes, "2 Most Common Wood Species for Pallets and Why," NelsonBlog, last modified October 30, 2014, accessed April 2, 2019, https://blog.nelsoncompany.com/home/2-most-common-wood-species-for-pallets-and-why

Woody Fiber Fuel - NHSM Self-Certification Documentation

- Shipping materials are expected to contain nails, screws, bolts, straps, staples, lag screws, and metal connectors; and will require processing to remove metal.¹⁰
- 5. Utility companies generate and collect wooden cable spools, end-of-life utility poles, and wooden shipping and crating materials. Wooden cable spools are generally considered reusable. However, wooden cable spools are often rendered unusable by damage in the field, and reuse of wooden cable spools is transportation intensive and generally uneconomical. Large wooden cable spools are commonly constructed of milled, dried softwood such as pine, fir, or poplar held together with steel staples, nails, bolts, and studs. Smaller spools are constructed with plywood sides and heavy cardboard centers, fastened together by staples, nails, bolts, and studs. With sufficient sorting and processing, wooden cable spools can be beneficially and economically used as kiln fuel. Utility poles are most often made of Douglas fir, Jack Pine, Lodgepole Pine, Pacific Silver Fir, or Western Red Cedar. 11 Utility poles are typically treated with creosote made from coal tar, oil-borne preservatives including pentachlorophenol, and water-borne preservatives. Water-borne preservatives include copper arsenate 12 which can prevent rot or infestation by termites. Most utility poles are currently deposited in landfills, however end-of-life utility poles can be used as landscaping material, decking, or other lumber products such as fencing or other structural supports.¹³ With sufficient sorting and processing, utility poles can be used as kiln fuel.
- Large-scale agriculture generates substantial quantities of tree nut shells such as almond, pecan, or walnut shells. Tree nut shells have limited commercial use but are often used as fuel with limited processing.
- 7. Before processing, the material that makes up woody fiber fuel has limited fuel value due to the highly variable energy content, handling characteristics, and volatile content of its constituents, as well as the potential presence of foreign material. The source materials are generally low in contaminants but still require selection, sizing, metal removal, sorting, blending, and homogenizing.
- 8. Woody Fiber Fuel is primarily made up of wood particles and chips. It is a low-density solid material with particle size distribution characteristic of shredded or crushed fungible commodities. Maximum particle size is determined strictly by the amount of processing required to produce an efficient fuel product. Although a typical maximum particle size is 4-6" nominal or less, fuel product requirements are dictated by the type of fuel feed equipment and fuel feed point in the kiln system. Processing of source materials to make

¹⁰ L. O. Anderson, "WOOD CRATE Design Manual," Agriculture Handbook, Published February 1964, accessed April 3, 2019, https://www.fpl.fs.fed.us/documnts/usda/ah252.pdf

¹¹ Nicole Barone Callahan, "Wood Utility Pole Life Cycle," The Environmental Literacy Council, last modified 2015, accessed April 3, 2019, https://enviroliteracy.org/environment-society/life-cycle-analysis/wood-utility-pole-life-cycle/

EPRI, "Wood Utility Pole Life Cycle," Electric Power Research Institute, Published 2002, accessed April 4, 2019, http://wooddoc.org/utils/General/EPRI_Treated_Wood_Poles_In_Use_In_the_Environment_QA.pdf
 Callahan, "Wood Utility Pole," 2015

Woody Fiber Fuel is likely to produce minimal quantities of fine particles, although the material components of Woody Fiber Fuel are not generally friable. The tendency of Woody Fiber Fuel to flow freely at material transfer points is almost strictly dependent on maximum particle size. Processed Woody Fiber Fuel has little tendency to agglomerate.

II. NHSM Determination Criteria

- A. Woody Fiber Fuel source material is sourced, processed, cleaned, transported and stored in a way that identifies it as a valuable commodity (40 CFR §241.3)(c)(1)(i). When not used as fuel, the components of Woody Fiber Fuel are often used in a variety of applications. A mixture of available types of wood fiber, scrap, and agricultural co-products will vary considerably over the long term, but provides homogeneous fuel quality in the typical time frame of inventory management.
 - SOURCE CONTROL Generators of woody fiber source material fall into five general categories.
 - a. One, industrial or manufacturing facilities that generate manufacturing co-products or byproducts where source material is isolated at the point of generation with the intent of recycling or repurposing (Industrial Generators). As an example, companies that manufacture log homes, fence posts, dimension lumber, crates, pallets, shipping material, or structural timber produce a large volume of scrap.
 - Two, large commercial-scale sources such as storage and transfer facilities or utility companies that collect large quantities of sorted, non-comingled scrap or secondary material (Large Commercial Generators).
 - c. Three, agricultural industries such as farms or grain mills that produce large quantities of tree nut shells, seed hulls, or off-spec grain (Agricultural Generators).
 - Four, small commercial sources such as landscaping companies that produce volumes of tree trimmings, chipped wood, bark, pine cones and leaves (Small Commercial Generators).
 - e. Five, municipal facilities that collect tree trimmings or landscape waste as an isolated stream (Municipal Generators).

Prior to selection as a supplier of source material, generators must demonstrate the technical, operational, and administrative capacity to adequately guarantee product control. All generators are expected to have established acceptance and rejection standards, adequate management structure and staffing for effective operation, mechanical and administrative means to assure product control, and facilities that conform to accepted norms of operation and comply with legal and environmental standards. After selection,

generators are subject to regular audit to assure continued adherence to the established performance standards.

In cases where source material is obtained from Industrial Generators, Large Commercial Generators, Agricultural Generators or Small Commercial Generators, Generator performance is managed under a Materials Management Agreement ("Agreement"). The Agreement terms stipulate non-waste status of source material and require the Generator to certify non-waste source material status. The Agreement terms also stipulate product control from the point of generation, control of inventories, rejection of hazardous waste or solid waste, isolation from contaminants, identification and handling of non-conforming source material, and consistency of product makeup. Each Agreement includes a specification of each source material received, including sampling regimen and frequency.

In cases where the source material is generated from manufacturing processes, the source material is collected at the point of generation and transferred to storage at the source facility. The source material may be mixed or comingled with similar source materials originating in the same facility. Source materials may not be mixed or commingled with trash, refuse, contaminants, or any materials that do not fit the description of constituents of Woody Fiber Fuel. For example, in the manufacture of log homes, posts, poles, or dimension lumber, if bark or wood chips are generated at different points in the manufacturing process, the bark and wood chips may be mixed in the same inventory at the source facility but may not be mixed with plastic, paper, oils, trash, etc. Small incidental quantities of materials, such as plastic surveyors' flagging from forest operations are considered normal and acceptable. Source materials at the generator facility will be stored in areas designated for the specific purpose, and those areas are maintained to prevent cross contamination with materials that are not components of the source material for Woody Fiber Fuel.

In the case of Municipal Generators, post-consumer woody fiber, including wood, tree trimmings and yard trimmings is received as a non-comingled stream at municipal waste facilities. In 2013, nearly 20 percent of the total material received was identified as wood or yard trimmings. Municipal facilities received just over 50-million tons of wood and yard trimmings, 60 percent of which was recycled, composted, or combusted for energy recovery. The remaining 22-million tons, was landfilled.¹⁴ The recovery of multiple beneficial products is a well-established practice across the United States. In 2013 nearly 4,000 different municipal recycling facilities including 800 MRFs managed 262-million tons of total material of which 125-million tons, or 47 percent, was recycled, combusted for energy recovery, or composted.¹⁵ Post-consumer material recycling requires that materials

¹⁴ Environmental Research and Education Foundation, "Municipal Solid Waste Management in the U.S.: 2010 and 2013," published 2016.

¹⁵ lbid.

processed be suitable for reentry into the recycled raw material stream to be used in consumer product manufacturing. Collection and delivery practices are in place to exclude material identified as general refuse, solid waste, or hazardous waste. 16 In order to be considered as suppliers of woody fiber source material for GCC, Municipal Generators must demonstrate the same standards of material acceptance and rejection as commercial sources. When Municipal Generators are privately operated by contractors, contractors are subject to a Materials Management Agreement ("Agreement"). The Agreement terms stipulate non-waste status of source material and require the Generator to certify nonwaste source material status. The Agreement terms also stipulate product control from the point of generation, control of inventories, rejection of hazardous waste or solid waste, isolation from contaminants, identification and handling of non-conforming source material, and consistency of product makeup. Each Agreement includes a specification of each source material received, including sampling regimen and frequency. In cases where Municipal Generators are operated by government entities that are prohibited from entering into a Materials Management Agreement, an Alternative Fuels Guidance Document, ("Fuels Guidance") in the same form as a Materials Management Agreement, is adopted. Each Fuels Guidance includes a specification of each source material received, including sampling regimen and frequency.

- IDENTIFICATION, SELECTION AND EXCLUSION OF SOURCE MATERIAL The source material
 used in Woody Fiber Fuel is evaluated according to the four classes of source material
 defined in Section I.B.1 of this document and referenced herein.
 - (i) Clean Biomass;
 - (ii) Biomass-Like;
 - (iii) Categorical Material;
 - (iv) Legitimized Material.
 - a. Clean Biomass materials as defined in Section I.B.1.a of this document include materials that already meet the definition of Clean Cellulosic Biomass in 40 CFR §241.2 Definitions and are generated by any of the five generator types in Section II.A.1.a-e SOURCE CONTROL: Industrial Generators, Large Commercial Generators, Agricultural Generators, Small Commercial Generators, Municipal Generators. This class of materials includes at least:
 - Wood chips, bark, branches, and similar scrap left over from the manufacture of log homes, fence posts, dimension lumber, structural timber, or other wood products

¹⁶ Waste Management, "Single Stream Specifications," Waste Management, accessed January 8, 2019, https://www.wm.com/recycling-services/pdfs/SingleStream.pdf.

- where native forest wood is used to create marketable goods and is not intermixed with any non-wood materials and has not been discarded.
- Wood collected from forest thinning or disaster recovery operations where native forest wood is not intermixed with any non-wood materials and has not been discarded.
- iii. Urban wood, as described in the definition of Clean Cellulosic Biomass, is made up of branches, sticks, bark, tree trimmings, pine cones, and similar materials that have not been discarded and have not been intermixed with trash, refuse, contaminants, or non-wood-like material.
- iv. Tree nut hulls, grain hulls, grain residues or similar biomass from agricultural operations where native forest wood is not intermixed with any non-wood materials and has not been discarded.
- v. Untreated wood shipping pallets that have not been intermixed with any non-wood materials and have not been discarded. Shipping pallets may require some processing to remove nails, staples, packing straps, and wrapping.
- b. Biomass-Like materials as defined in Section I.B.1.b of this document include materials that bear strong chemical and physical similarities to the definition of clean cellulosic biomass but are not specifically referenced in 40 CFR §241.2 definition for Clean Cellulosic Biomass and are generated by any of the five generator types listed in Section II.A.1 SOURCECONTROL: Industrial Generators, Large Commercial Generators, Agricultural Generators, Small Commercial Generators, Municipal Generators. This class of materials includes:
 - i. Untreated shipping and packing crates, spacers, dividers, blocks and similar devices from shipping and storage operations whose purpose is principally the same as shipping pallets; have not been discarded and have not been intermixed with trash, refuse, contaminants, or dissimilar materials. These materials may require some processing to remove nails, staples, packing straps, and wrapping material.
 - ii. Untreated cross arms and braces from utility poles, wooden cable spools, untreated structural timber, and similar wood objects whose structural makeup and chemical contents are principally the same as shipping pallets, structural timber or dimension lumber; have not been discarded and have not been intermixed with trash, refuse, contaminants, or dissimilar materials. These materials may be made of hardwood such as ash or white oak, or of softwood such as pine, fir or poplar. These objects are frequently joined or secured by bolts, screws, nails, studs; may contain metal wear plates, gussets, bracing, or fish plates, and are likely to require processing or manual sorting.

- c. Categorical Material as defined in Section I.B.1.c of this document includes materials that are already subject to a categorical exclusion or are chemically and physically indistinguishable from materials which are subject to a categorical exclusion and may be generated by any of the five generator types listed in Section II.A.1.(a-e) SOURCE CONTROL: Industrial Generators, Large Commercial Generators, Agricultural Generators, Small Commercial Generators, Municipal Generators. This class of materials incudes:
 - Construction and Demolition wood (C&D wood) that has been managed, sorted, processed, and handled in accordance with the categorical exclusion for C&D wood.
 - Creosote treated or other treated railroad ties (CTRT and OTRT) that have been source controlled, managed, processed, and handled in accordance with the categorical exclusion for CTRT and OTRT.
- iii. Treated utility poles whose chemical makeup is principally the same as the chemical makeup of CTRT or OTRT, have not been discarded, have been managed by a commercial entity with a scrap management system, and have not been comingled with trash, refuse, or contaminants. Processing to remove metal is required.
- d. Legitimized Material as defined in Section I.B.1.d of this document includes materials that are made up principally of biomass and can be made to conform to the legitimacy criteria for Non-Hazardous Secondary Material using the processing and qualification measures specified in this document and its description of Woody Fiber Fuel. Legitimized material source material may be generated only by Industrial Generators, Large Commercial Generators, Agricultural Generators or Small Commercial Generators as listed in Section II.A.1.(a-d) SOURCE CONTROL. Material generated by Municipal Generators listed in Section II.A.1.(e) SOURCE CONTROL is excluded because of the potential for variability and the potential requirement for additional processing for removal of contaminants. Legitimized Material must:
 - Be produced as a commodity with economic value, or be a co-product of a manufacturing process for a commodity with economic value; and,
 - ii. Not have been discarded at any time since its generation; and,
 - Require minimal manual sorting and inspection, removal of ferrous metal, and processing for sizing and homogeneity to meet the processing criteria specified in this document; and,
 - iv. Have tested calorific value greater than 5,000 Btu/lb.; and,
 - Have contaminants that fall within the range of traditional solid fuels as identified in Section III Table 2 of this document; or,

- (i) If one of the constituents slightly exceeds the traditional fuel value (e.g., by 25% or less), the facility will document that it is comparable. The 25% will be applied except in the case of a known human carcinogen constituent (such as for arsenic or benzene). The fuel specification values may be modified in the future if additional data is available for traditional fuels that may expand the ranges currently in the fuel spec table.
- (ii) In the event any individual constituent value exceeds value described above for the corresponding traditional fuel value, the data may be compared on a grouping basis. The groupings that are pertinent to use for the fuel comparison for a cement plant include:
 - LVMs (low-volatile metals): Group includes antimony, beryllium, chromium, cobalt, manganese, and nickel compounds. Arsenic is not included within the LVM group for this analysis since it is a known human carcinogen.
 - 2. SVMs (semi-volatile metals): Group includes lead, cadmium, and selenium compounds.
 - 3. Halogens: Group includes chlorine and fluorine.
 - 4. Semi-volatile organics: Group includes Hazardous Air Pollutants identified by EPA SW-846 Method 8270.
 - 5. Volatile Organic Chemicals (VOCs): Group includes Hazardous Air Pollutants by EPA SW-846 Method 8260. Benzene is not included within the VOC group for this analysis since it is a known human carcinogen.

Certain materials are subject to additional testing, regardless of classification and regardless of demonstration of non-waste status. These materials have been known to exhibit periodic high content of one or more contaminants, or may contain one or more constituents that could adversely affect the cement manufacturing process. This list of materials includes grains, eastern oak bark, vineyard wood (grape vine trimmings), hemlock bark, eucalyptus wood and bark, other vinous material. Prior to consideration as a constituent on Woody Fiber Fuel, any of these materials shall be evaluated for halogens, alkalis, mineral content, and metal contaminants. Contaminant levels will be compared to contaminant ranges for traditional solid fuel in Section III, TABLE 2.

Certain materials have a statistically high likelihood of exceeding one or more contaminant concentration limits and are excluded in their entirety regardless of demonstration of non-waste status. This group of materials includes particle board, painted wood, lacquered

¹⁷ Phyllis2, database for biomass and waste, https://phyllis.nl/, ECN.TNO

wood, chemically treated wood, waste from treated wood, salt-impregnated wood, and wood from composting plants, paper pulp, and underwater wood.¹⁸

TESTING AND INSPECTION OF SOURCE MATERIAL – Source material from clearly identifiable
clean biomass sources may be used with minimal testing to assure calorific content, sulfur,
nitrogen, and halogens. The source material is tested by the combustion facility and
processor prior to use, and thereafter, at intervals agreed upon by the generator, processor,
and combustion facility.

Source material from common untreated manufactured goods such as shipping pallets and similar shipping materials, cable spools, dimension lumber or scrap lumber, and similar materials is tested prior to consideration for use for calorific content, sulfur, nitrogen, halogens, metals, and volatile organic hazardous air pollutants. The source material is tested by the combustion facility and processor prior to use, and thereafter, at intervals agreed upon by the generator, processor, and combustion facility.

Source material from less common treated or untreated manufactured goods such as shipping pallets and similar shipping materials, cable spools, utility poles and cross arms, dimension lumber or scrap lumber, and similar materials is tested prior to any consideration for use for calorific content, sulfur, nitrogen, halogens, metals and volatile organic hazardous air pollutants. The source material is tested by the combustion facility and processor prior to use, and thereafter at intervals, agreed between the generator, processor, and combustion facility.

4. RECEIPT AND INTAKE OF SOURCE MATERIAL – Source material is received by truck or by rail from the generator. Material acceptance is governed in accordance with standards set forth in the Materials Management Agreement or Fuels Guidance and their attached specifications. Materials receipt is managed by trained personnel. Incoming materials are first examined to verify that they meet the description set forth in the specification. Any incoming material that does not meet the specification criteria is considered non-conforming material. Loads with identified non-conforming material are rejected prior to acceptance and returned to the generator.

Methods of tracking incoming source material, including documentation procedures, are defined in the QAQC plan for the processor and combustion facility.

Non-conforming material that is identified after incoming woody fiber source material has been accepted by the GCC processor or the GCC combustion facility is evaluated in accordance with South Dakota regulations under the definition of Solid Waste in SDCL: 34A-6-1.3(17) and treated in a manner appropriate to the material type. In general, non-conforming material is isolated from woody fiber source material and other consumable

¹⁸ Phyllis2, op cit.

materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility and is held only as long as necessary to arrange for proper disposition as outlined below.

Non-conforming, non-waste material is, when possible, used in another part of the process at the combustion facility if the non-waste material meets the definition of, and conforms to the specifications of, a non-hazardous secondary material fuel or ingredient that is already qualified for use at the combustion facility AND is already used at the combustion facility. In this case, "non-conforming material" refers only to material that does not conform to the specifications of woody fiber source material or Woody Fiber Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that non-conforming material to the correct inventory, and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility, it will be transferred or disposed of as appropriate.

Non-conforming, non-hazardous material that is identified as solid waste is transferred to a landfill that accepts the type of waste. Inventory records will reflect the transfer of that non-conforming material to. Non-conforming material that is identified as non-hazardous liquid waste, non-hazardaus semisalid waste or non-hazardous contained gaseous waste is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

Non-conforming material that is identified as hazardous waste is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the type of waste identified, and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

5. PROCESSING AND REMOVAL OF CONTAMINANTS – Source material that is in whole form is examined visually for contaminants such as plastic wrap or labeling, glass or ceramic hardware, and non-ferrous metal. Identified contaminants are removed manually or mechanically. Source material in whole form and source material in particle size sufficiently large to capture contaminants are shredded to coarse size fractions. Shredding is followed by magnetic separation to remove ferrous metals. Source materials from one or more sources are further shredded or chipped and screened as necessary to create a product with uniform maximum particle size that has handling characteristics similar to traditional solid fuels. Source materials from one or more sources are mixed and homogenized, either manually or mechanically to produce a blend of consistent particle makeup and quality. The finished Woody Fiber Fuel is passed through a magnetic separator to remove any remaining ferrous metal.

- 6. SUMMARY OF THE "PROCESSING CRITERIA" Woody Fiber Fuel meets the requirement of sufficient processing as supported by process descriptions used in the Categorical Exclusion for C&D Wood from C&D debris. The treatment of exclusion and sorting by the collection facility and generator of woody fiber source material is similar to the requirements for positive and negative sorting in the Categorical Exclusion of C&D wood processed from C&D debris¹⁹ and training in the non-waste determination for SpecFUEL.²⁰ The selection, exclusion, sorting, and processing steps to produce Woody Fiber Fuel are nearly identical to the steps described in the non-waste determination of Roaring Spring Biofuel "fuel cubes"²¹ and highly similar to the processing steps and general makeup of the material described in the non-waste determination of Greenwood Fuels LLC "fuel pellets".²²
- B. Documentation of chemical characteristics of Woody Fiber Fuel was obtained from public databases that report data on biomass, native wood, wood as a component of consumer products, wood-like material, treated and untreated wood, and many types of scrap wood. Over 700 sample reports were included in the chemical and contaminant comparison. Not all available reports included all applicable parameters but a substantial body of evidence is available. In addition, physical samples of representative material were gathered and analyzed to corroborate public data. Available documentation establishes that the material chemical and physical properties of Woody Fiber Fuel are comparable to commercial solid fuels used in cement manufacturing as required by 40 CFR §241.3(c)(1)(ii).
 - Woody Fiber Fuel meets the requirement for meaningful heating value used in unit that
 recovers energy as required by 40 CFR §241.3(d)(ii), which is generally accepted to be at
 least 5,000 Btu/lb. Calorific value reported for more than 400 samples show average net
 calorific value (LHV) of approximately 8,200 Btu/lb. The lowest reported LHV values were in
 the range of 5,400 Btu/lb and the highest LHV values were in the range of 10,700 Btu/lb²⁴.
 Measured calorific value from physical samples of woody fiber fuel source material ranged
 between 8,050 Btu/lb and 8,750 Btu/lb.
 - Contaminant concentrations of Woody Fiber Fuel are lower than those typical of traditional solid fuels or coal used in the cement manufacturing process as required under 40 CFR §241.3(d)(iii). Concentrations of chlorine, fluorine and nitrogen were comparable between

¹⁹ Non-Waste Determinations for Specific Non-Hazardous Secondary Materials When Used as a Fuel., 40 C.F.R. § 241.4 (2018).

²⁰ Letter by Barnes Johnson, "Non-waste determination for SpecFUEL," n.d., accessed December 20, 2018, https://archive.epa.gov/epawaste/nonhaz/define/web/pdf/specfuel.pdf.

²¹ United States Environmental Protection Agency (EPA), 2013-02-06 "non-waste determination for fuel cubes" letter to Roaring Spring Biofuel.

²² United States Environmental Protection Agency (EPA), 2011-11-14 "non-waste determination for fuel pellets" letter to James S. Rickrun Environmental Consulting.

²³ Phyllis2, database for biomass and waste, https://phyllis.nl/, ECN.TNO

²⁴ Phyllis2, op cit.

Woody Fiber Fuel and traditional solid fuel. Sulfur content of Woody Fiber Fuel compared to the low end of the range of traditional fuel.

- (i) If one of the constituents slightly exceeds the traditional fuel value (e.g., by 25% or less), the facility will document that it is comparable. The 25% will be applied except in the case of a known human carcinogen constituent (such as for arsenic or benzene). The fuel specification values may be modified in the future if additional data is available for traditional fuels that may expand the ranges currently in the fuel spec table.
- (ii) In the event any individual constituent value exceeds value described above for the corresponding traditional fuel value, the data may be compared on a grouping basis. The groupings that are pertinent to use for the fuel comparison for a cement plant include:
 - 1. LVMs (low-volatile metals): Group includes antimony, beryllium, chromium, cobalt, manganese, and nickel compounds. Arsenic is not included within the LVM group for this analysis since it is a known human carcinogen.
 - 2. SVMs (semi-volatile metals): Group includes lead, cadmium and selenium compounds.
 - 3. Halogens: Group includes chlorine and fluorine.
 - 4. Semi-volatile organics: Group includes Hazardous Air Pollutants identified by EPA SW-846 Method 8270.
 - 5. Volatile Organic Chemicals (VOCs): Group includes Hazardous Air Pollutants by EPA SW-846 Method 8260. Benzene is not included within the VOC group for this analysis since it is a known human carcinogen
- C. The storage and materials management of woody fiber source material and Woody Fiber Fuel at all phases from generation to the point of combustion meet the requirements of (40 CFR §241.3)(c)(1)(iii) and (40 CFR §241.3(d)(1)(i)(A))).
 - 1. Woody fiber and Woody Fiber Fuel are not accumulated in any significant quantity or for any significant period of time at any generator facility, at the processor, or at the combustion facility. Typical storage time by the generator is less than three months from the time of generation to the time the material is distributed. Storage time may vary seasonally depending on supply, market demand for recycled material, and logistical constraints. Commercial and industrial generators who ship by rail may be constrained by more competitive intermodal commodities. When woody fiber source material or finished, Woody Fiber Fuel is shipped and weighed with weights recorded on a uniform bill of lading. Records of distribution are recorded and retained. Woody fiber source material shipped

from generator facilities may be combusted for energy recovery, pelletized to make stove pellets, laminated to manufacture particle board or oriented-strand board, dyed to make landscape mulch, sold as an absorbent for livestock pen lining, generated into pulp to make paper or cardboard products, blended with other material to use as fuel, or used as compost. Woody fiber source material that cannot be distributed into beneficial-use markets may be landfilled. In any case, when source material has been stored for more than one year by the generator, it is assumed to have degraded in quality due to water infiltration and will not be considered for use in Woody Fiber Fuel.

Woody Fiber Fuel is a solid material in loose bulk form with handling characteristics similar to low-density traditional solid fuels. Storage and management of Woody Fiber Fuel at GCC facilities is comparable to storage and management of the traditional solid fuels that the same GCC facilities. Woody Fiber Fuel is delivered by trucks with dump trailers or walking floor trailers. Incoming material is weighed, and weights are compared to weights on the bill of lading. Material is accounted for in accordance with inventory management practices established for other bulk solid fuel and raw material at the combustion facility. Inventory is valued on a first-in, first-out basis. Inventories most commonly contain a supply sufficient for 30-60 days of operation, but rarely longer than 3 months due to the concern of moisture retention and quality degradation. Inventory time frame is comparable to the time frame in EPA's speculative accumulation concept in RCRA and is consistent with GCC's solid traditional fuels inventory management time frames.

D. In accordance with 40 CFR §241.3(d)(1)(B) and (C) woody fiber source material and Woody Fiber Fuel is handled in a manner similar to that for traditional solid fuel to prevent releases to air, water or land.

²⁵Woodchuck, "Wood Manufacturing By-Products," Cal Cedar, last modified November 23, 2005, accessed April 1,2019, http://calcedar.com/wood-manufacturing-by-products/

²⁶ Franz Schmithüsen, "Entrepreneurship and Management in Forestry and Wood Processing," googlebooks, https://books.google.com/books?id=MyfLCQAAQBAJ&pg=PA60&lpg=PA60&dq=wood+product+manufacturing+coproducts&source=bl&ots=CufUKBSGVa&sig=ACfU3U2z6pJH-

Bhvt8UdPkAAypPKi6uTHg&hl=en&sa=X&ved=2ahUKEwix95b3q6_hAhUEXK0KHflwATEQ6AEwBHoECAgQAQ#v=one page&q=wood%20product%20manufacturing%20coproducts&f=false

²⁷ Richard D. Bergman, "LIFE CYCLE INVENTORY OF MANUFACTURING PREFINISHED ENGINEERED WOOD FLOORING IN EASTERN US WITH COMPARSION TO SOLID STRIP WOOD FLOORING," Wood and Fiber Science, Published October 2011, accessed April 1,2019,

https://www.fpl.fs.fed.us/documnts/pdf2011/fpl_2011_bergman003.pdf

²⁸ USEPA, Advancing Sustainable Materials Management: Facts and Figures Report, "Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States", July, 2018

²⁹ USEPA, Advancing Sustainable Materials Management: Facts and Figures Report, "Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States", July, 2018

1. Woody fiber source material is transported in covered or uncovered trailers appropriate to the type of material. Source material in whole form, such as shipping pallets, blocking, dimension lumber, utility poles and cross arms, shipping crates and cable spools, may be transported on open flatbed trailers or rail cars. Because of their minimal tendency to degrade, these whole materials may be stored outdoors for periods up to several months in the arid climates typical to GCC's plant locations. Inventories are not tracked by weight until transferred for initial processing. After initial processing for size reduction, these same materials may be stored outdoors only for limited periods of time because of the tendency for leachates that may increase chemical oxygen demand (COD) and produce phenols, organic compounds and resin acids.³⁰

Woody fiber source material that is already in chipped, shredded, or size-reduced form; or woody fiber containing small particles such as bark, grain, nut hulls or similar particle type are transported in covered trailers or rail cars to contain airborne loss or water infiltration. These materials may be stored unprotected outdoors only for limited periods of time because of the propensity to generate leachates that may increase chemical oxygen demand (COD) and produce phenols, organic compounds, and resin acids.³¹

2. Constituent releases to water or land from woody fiber may occur from water leaching. Releases to air are unlikely except in cases of fire. Outdoor storage of woody fiber source material and Woody Fiber Fuel must be covered to prevent water infiltration. Any runoff caused by rainwater release is controlled in accordance with a storm water management plan. The generator site, processor site, and combustion location are designed to limit water infiltration of material, and any water generated on site is subject to the requirements of NPDES permit requirements or similar governing requirements.

Woody fiber and Woody Fiber Fuel can catch fire by ignition or by spontaneous combustion. When stored outdoors or indoors, woody fiber and Woody Fiber Fuel are stored in accordance with NFPA 230 guidelines³² to prevent releases to air.

- a. Piles separated from one another by approved fire apparatus access roads.
- b. Low barrier walls provided around piles to define pile perimeter and prevent creeping.
- c. Physical protection provided to prevent heat sources such as steam lines, air lines, electric motors and mechanical drive equipment from becoming buried or heavily coated with material.

³⁰ Rex, john *et al*, "Investigating Potential Toxicity of Leachate from Wood Chip Piles Generated by Roadside Biomass Operations," *Farests*, **2016**, 7, 40; doi:10.3390/f7020040.

³¹ Rex, John et al, op cit.

³² https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=230, accessed April, 2019.

- d. A minimum of 15 feet maintained between piles and exposing structures, yard equipment or stock depending on the degree of the exposure.
- Appropriate number of fire extinguishers suitable for Class A fires shall be provided in accordance with NFPA 10, Standard for Portable Fire Extinguishers.
- Water supplies in the area shall be provided in accordance with NFPA 1 Uniform Fire Code.
- g. Pile temperature monitored using infrared scanners.
- 3. At the generator facility, woody fiber source material collection, processing, transfer, storage, and loading is conducted in a way that minimizes air-borne and water-borne dispersion. Trucks transporting woody fiber source material are covered to prevent airborne releases. Rainwater releases are controlled in accordance with a storm water management plan. The generator site is designed to limit water infiltration of material and any water generated on site is subject to the requirements of NPDES permit requirements or similar governing requirements. Fugitive air emissions are governed by air permit requirements or practices appropriate for the size and type of facility, with controls similar to traditional solid fuels.
- 4. At the combustion facility, rainwater releases from the Woody Fiber Fuel management area at the GCC facilities are controlled by an NPDES storm water permit. Fugitive air emissions are governed by the Title V air permit requirements, and Title V permits are held where required. Air emissions controls comparable to controls used for traditional solid fuels are in place.
- 5. Non-conforming material that is identified after incoming woody fiber source material or Woody Fiber Fuel has been accepted by the GCC processor or GCC combustion facility is evaluated in accordance with South Dakota regulations under the definition of Solid Waste in SDCL: 34A-6-1.3(17) and treated in a manner appropriate to the material type. In general, non-conforming material is isolated from woody fiber source material and Woody Fiber Fuel and is isolated from other consumable materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility and is held only as long as necessary to arrange for proper disposition as outlined below.

Non-conforming, non-waste material is, when possible, used in another part of the process at the combustion facility if the non-waste material meets the definition of, and conforms to the specifications of, a non-hazardous secondary material fuel or ingredient that is already qualified for use at the combustion facility AND is already used at the combustion facility. In this case, "non-conforming material" refers only to material that does not conform to the specifications of Woody Fiber Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that

non-conforming material to the correct inventory, and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility, it will be transferred or disposed of as appropriate.

Non-conforming, non-hazardous material that is identified as solid waste is delivered to a landfill that accepts the type of waste. Non-conforming, non-hazardous material that is identified as non-hazardous liquid waste, non-hazardous semisolid waste or non-hazardous contained gaseous waste is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

Non-conforming hazardous waste material that is identified is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the type of waste identified, and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

SDCL: 34A-6-1.3(17) "Solid waste," any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include mining waste in connection with a mine permitted under Title 45, hazardous waste as defined under chapter 34A-11, solid or dissolved materials in domestic sewage or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended to January 1, 2011, or source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended to January 1, 2011;

E. Other relevant factors

- Many woody fiber source materials are widely recycled, re-used, sold as a valuable commodity, or composted.^{33,34,35,36,37} However, significant amounts of woody fiber source material are still discarded in landfills.³⁸ Overall, in 2015 just 44 percent of all potential woody fiber source material was recycled, composted, or combusted for energy recovery, with the remaining amount landfilled.³⁹
- 2. Compared to other common alternative fuels such as tire-derived fuel, Woody Fiber Fuel is easy to control from the source, easy to document handling from the point of generation to the point of processing, and is easy to process in conventional shredding and screening equipment. Selection by positive and negative sorting is straightforward. Woody fiber source material is characteristically low in contaminants. Woody fiber source material is plentiful and can be viewed as an under-utilized resource. Woody Fiber Fuel, when properly source-controlled and processed, is a desirable fuel source for cement kilns. The combination of very long resident times and high temperatures in the cement kiln makes cement processing an ideal combustion environment. The ubiquity of woody fiber source material is such that it is relatively easy to arrive at a fuel mixture that is homogeneous and chemically compatible with the cement manufacturing process. The average net calorific value (LHV) of approximately 8,200 Btu/lb of Woody Fiber Fuel is low compared to many traditional solid fuels, however, it is sufficient to make a valuable contribution to the cement manufacturing process. Ash content, sulfur, and nitrogen are very low. Mineral content of the ash component is negligible and primarily made up of silica, aluminum, calcium, and sodium. Alkali concentrations are lower than those for traditional solid fuel and at concentrations that will not adversely affect the cement manufacturing process.

³³ Woodchuck, "Wood Manufacturing By-Products," Cal Cedar, last modified November 23, 2005, accessed April 1,2019, http://calcedar.com/wood-manufacturing-by-products/

³⁴ Richard D. Bergman, "LIFE CYCLE INVENTORY OF MANUFACTURING PREFINISHED ENGINEERED WOOD FLOORING IN EASTERN US WITH COMPARSION TO SOLID STRIP WOOD FLOORING," Wood and Fiber Science, Published October 2011, accessed April 1,2019,

https://www.fpl.fs.fed.us/documnts/pdf2011/fpl_2011_bergman003.pdf

³⁵ Greb, Peggy, "Nixing Nitrogen Flow From the Farm," Agricultural Research, February, 2012, p. 18.

³⁶ USEPA, Advancing Sustainable Materials Management: Facts and Figures Report, "Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States", July, 2018.

³⁷ Jonas Bengtsson, "Life cycle assessment of one-way and pooled pallet alternatives," ScienceDirect, Published 2015, accessed April 3,2019,

https://reader.elsevier.com/reader/sd/pii/S2212827115000852? token=50E8CBB1539EE0B1AD8BEB37E581779E277323E97FCD

³⁸ USEPA, July, 2018, ibid.

³⁹ USEPA, July, 2018, *ibid*.

III. TABLE 1: FUEL SPECIFICATION AND COMPARISON

Chemical Name	CAS Number	Number of Samples	Units	WOODY FIBER FUEL Range/ Typical	Solid Traditional Fuel Range (ppm)	Solid Trad. Fuel Spec (ppm)	Comparison of WOODY FIBER FUEL to Solid Fuel
Metal Elements, ppm - dry basis	n - dry basis						
Mercury (Hg)	7439-97-6	23	mg/kg	ND-0,8	ND-13.8	13.8	Lower than solid fuel
Cadmium (Cd)	7440-43-9	54	mg/kg	ND-3.3	ND-19		Lower than solid fuel
Lead (Pb)	7440-92-1	89	mg/kg	ND-100	ND-300		Lower than solid fuel
Selenium (Se)	7782-49-2	14	mg/kg	ND-2.1	ND-74.3		Lower than solid fuel
Arsenic (As)	7440-38-2	44	mg/kg	ND-6.8	ND-298	298	Lower than solid fuel
Antimony (Sb)	7440-36-0	22	mg/kg	ND-2.9	ND-26		Lower than solid fuel
Beryllium (Be)	7440-41-7	8	mg/kg	ND-0.07	ND-206		Lower than solid fuel
Chromium (Cr)	7440-47-3	62	mg/kg	ND-92	ND-340		Lower than solid fuel
Cobalt (Co)	7440-48-4	21	mg/kg	ND-9	ND-213		Lower than solid fuel
Manganese (Mn)	7439-96-5	74	mg/kg	ND-390	ND-15,800		Lower than solid fuel
Nickel (Ni)	7440-02-0	47	mg/kg	ND-65	ND-730		Lower than solid fuel

TABLE 1: FUEL SPECIFICATION AND COMPARISON

Chemical Name	CAS	Number of Samples	Units	WOODY FIBER FUEL Range/ Typical	Solid Traditional Fuel Range (ppm)	Solid Trad. Fuel Spec (ppm)	Comparison of WOODY FIBER FUEL to Solid Fuel
Non-metal Elements, ppm - dry basis	its, ppm - dry ba	sis					
Chlorine (CI)	7782-50-5	248	mg/kg	ND-4,200	ND-9080		Lower than solid fuel
Fluorine (F)	7782-41-4	24	mg/kg	ND-65	ND-300	1	Lower than solid fuel
Nitrogen	7727-37-9	434	mg/kg	200-29,300	ND-54,000	67,500	Lower than solid fuel
Sulfur (S)	7704-34-9	367	mg/kg	300-880	000'66-QN	123,750	Lower than solid fuel
Volatile Organic Compounds (VOC), ppm	OOV) spunodmo	;), ppm - dry	- dry basis				
Benzene	71-43-2	5	mg/kg	ND	ND-38.6	38.6	Lower than solid fuel
Ethylbenzene	100-41-4	5	mg/kg	ND	0.7-5.4		Lower than solid fuel
Styrene	100-42-5	5	mg/kg	ND	1.0-26		Lower than solid fuel
Toluene	108-88-3	2	mg/kg	ND-0.54	8.6-56	ī	Lower than solid fuel
Cumene	98-82-8	2	mg/kg	N Q		ī	Lower than solid fuel
Formaldehyde	20-00-0	2	mg/kg	N Q	1.6-2.7	1	Lower than solid fuel
Hexane	110-54-3	5	mg/kg	N Q			Lower than solid fuel
Phenol	108-95-2	5	mg/kg	N Q			Lower than solid fuel
Xylenes	1330-20-7	5	mg/kg	ND	4.0-28	ì	Lower than solid fuel
Naphthalene	91-20-3	5	mg/kg	N Q			Lower than solid fuel
Biphenyl	92-52-4	5	mg/kg	ND			Lower than solid fuel
Polycyclic hydrocarbons		27	mg/kg	ND-3.3	14-2090		Lower than solid fuel

I. Introduction:

A. This document shows that processed end-of-life wind turbine blades utilized as an alternative fuel by GCC meets the definition of Non-Hazardous Secondary Material (NHSM) fuel as described at 40 CFR 241. The following sections describe Wind Turbine Blade Fuel and how the material meets NHSM regulations as a non- waste fuel. The Process Description section in the NHSM Management Manual contains a description of the cement manufacturing process, documents how the AF is used to replace fossil fuels, and explains the benefits of using alternative fuel from an environmental standpoint.

The wind turbine blade's high content of fiberglass and composite materials including wood, expanded foam, epoxy coating and a steel rod render it unusable as a commodity. Recycling of wind turbine blades is a relatively new development in that the blades typically have a 20-year life. With the very large size of the blades and multiple materials comprising of the blade, processing systems are needed for separation of wind turbine blades into usable recycling components.

- B. The typical wind turbine blade consists of the following:
 - Fiberglass = 76%
 - Resins (epoxy) = 18%
 - Wood/foam composites = 2%
 - Steel = 3%
 - Other = 1%
 - Fiberglass is fiber reinforced plastic utilizing glass fibers. The plastic is a thermoset polymer
 matrix typically epoxy, polyester resin or vinyl ester. The glass fibers are melted sand, some
 with mixtures of limestone or clay. The main component of the glass is silica, with smaller
 amounts of calcium and alumina. All these inorganic materials are not considered fuel but
 are needed raw material for producing cement.
 - 2. Fuel Value: Approximately 45% of the entire wind turbine blade has fuel value. The fuel components include the epoxy and polymer-based resins on the glass fiber, wood and expanded foam components, and the coating material on the blade. Following processing to remove the steel rod, the composite mixtures of materials have an energy value ranging from 5,200 BTU/lb. to 5,500 BTU/lb.
 - 3. Raw Material Value: Without processing, wind turbine blades would have limited value as fuel, due to the size and various components used to fabricate the blade. The steel rod will be extracted during the initial sizing of the wind turbine blade. The steel will be sent as scrap metal to a steel recycling facility to create new steel product. With > 50% of the wind turbine blade being an inorganic material mainly composed silica, calcium and alumina, all these components are needed raw materials in the cement manufacturing process. When fed to the cement kiln process as a part of the alternative fuel material, the high temperature atmosphere in the cement kiln utilizes the energy content to maintain process temperatures while the inorganic fraction combines with the normal raw cement mix

materials to form the needed oxides that form the cement product. In effect, the inorganics in the fiberglass are incorporated in the cement product the same way as the ash in coal is incorporated in the cement. The ash in coal is also mainly silica with lesser amounts of iron, calcium, and alumina.

4. The organic components of the Wind Turbine Blade Fuel supply beneficial fuel value replacing fossil fuels in GCC's cement manufacturing facilities. After processing, Wind Turbine Blade Fuel has a heat value lower but still comparable to traditional fuels and contains the inorganic components that are comparable to inorganic components of traditional fuels. There is no negative impact on the cement manufacturing process. Wind Turbine Blade Fuel material is introduced into the cement manufacturing process in the manner of a bulk solid fuel.

II. NHSM Determination Criteria

- A. Robust quality assurance and quality control procedures are in place throughout the processes of generation, beneficiation, material management, and final processing to assure that wind turbine blade fuel is treated as a product versus solid waste in accordance with 40 CFR §241.3(c)(1)(i).
 - 1. SOURCE CONTROL: Whole wind turbine blades are removed from the structure at the wind farm. A typical wind turbine blade is 122' (37 meters) in length with diameters of a portion of the blade up to 6'7". Preliminary sizing occurs in the field by cutting the full length into 40' sections to allow transportation of the blade to the processing facility. Wind turbine blades are received by the processor from subcontractors of the generator, who are subject to rigid material acceptance standards to exclude:
 - Other wind turbine system components such as
 - o Hub material
 - o Generator
 - o Oil materials
 - o Gear box materials
 - o Electrical components
 - Other misc. materials from the decommissioning process

Loads containing any of these prohibited items are rejected or when feasible, the excluded materials are separated and returned to the generator.

- RECEIPT OF MATERIALS: Materials are received by truck or by rail. Materials receipt is managed by trained personnel. Incoming materials undergo visual screening for items prohibited by material acceptance standards.
- REMOVAL OF CONTAMINANTS: Should other miscellaneous materials be observed with the
 wind turbine blades that are received and can easily be removed by hand or during
 processing, the load will be accepted, and the miscellaneous materials extracted.

Contaminants, in the form of expanded foam that contain PVC, will also be extracted where possible prior to placing the wind turbine blades in the primary shredder. The foam material may also be extracted following the shredding process by manually or mechanically sorting out the foam on the conveyor belt feeding the stacker conveyor.

- 4. INITIAL PROCESSING OF WIND TURBINE BLADES: The length of wind turbine blade received will be cut into 10' long sections for feeding the processing system. The 10' lengths are conveyor-fed into a primary shredding system that reduces the material to particle sizes that facilitate efficient separation. A cross belt ferrous metal removal system is used to extract any ferrous metals (steel rod components) from the material. Secondary shredding then follows to reduce the particle size to the required dimensions to be fed as a fuel to the cement process. Size reduction and consistency in particle size assure efficient separation into components of the fuel material and removed ferrous metal fraction.
- 5. PROCESSING OF FERROUS MATERIALS: Ferrous material that have been magnetically separated during processing have been sized into a dimension that allows for efficient placement into a scrap metal bulk container. Once full, the scrap metal container will be hauled to the metal recycler for transportation to the steel mill.
- 6. FINAL PROCESSING AT THE COMBUSTION FACILITY: If necessary, to meet particle size requirements for feed equipment design, further processing of the Wind Turbine Blade Fuel may be required. The processing, will consist of shredding and screening using conventional shredding equipment. Sieve analysis at the combustion facility is used to determine this final processing requirement.
- 7. SUMMARY OF THE "PROCESSING CRITERIA": Wind Turbine Blade Fuel meets the requirement of sufficient processing as supported by process descriptions used in the non-waste determination for processed oil filter fluff ¹ based on contaminant removal and sufficient processing. The materials used to produce wind turbine blade are under rigid source control. Material reception protocols include visual examination to ensure materials exclusion. Contaminants are removed by mechanical and manual means prior to processing. The Wind turbine blade is prepared for fuel use by separation and processing to isolate the foam materials with known PVC content from the remainder of the fuel material. Initial processing is performed at the receiving facility and may include mechanical or manual separation of contaminants in the wind turbine blade stream. Final preparation involves sizing and shredding followed by post PVC material separation. The resulting material is a mixture of wind turbine blade components that maximize the beneficial materials in wind turbine blades while separating contaminants such as ferrous metals and chlorinated materials. Processing of the wind turbine blade typically achieves a mixture that represents approximately 95 percent by weight of the unprocessed wind turbine blade, with

¹ United States Environmental Protection Agency (EPA), 2011-06-30 "Waste Determination for Oil Filter Fluff That Is Burned In Combustion Units" letter to Trendgreen Associates.

an energy content greater than 5,000 Btu/lb. The inorganic fraction that makes up the glass fiber in the wind turbine blades is a valuable resource for the cement process, being mainly silica, calcium and alumina. The inorganic fraction is liberated for beneficial use when the fiberglass is utilized as a fuel in the cement process.

- B. The following section and corresponding table provides documentation that the chemical and physical identity of Wind Turbine Blade Fuel is comparable to commercial fuels (40 CFR §241.3)(c)(1)(ii), that the material provides a heating value for GCC's cement kilns (40 CFR §241.3(d)(ii), and that contaminants in Wind Turbine Blade Fuel are comparable to those in traditional fuel (40 CFR §241.3(d)(iii).
 - MEANINGFUL HEAT VALUE: The processed Wind Turbine Blade Fuel has a meaningful fuel
 value as well as a significant raw material value for the cement process. Calorimetry of wind
 turbine blade samples show that the material has gross heating values in the range of 5,200
 to 5,500 Btu/lb on an as-received basis; which is greater than 5,000 Btu/lb threshold. The
 Wind Turbine Blade Fuel makes a useful contribution to the cement clinker manufacturing
 process both in the form of needed raw materials and heat input to drive the process.

CONTAMINANT COMPARISON: Table 1 compares contaminants of Wind Turbine Blade Fuel with those of the traditional fuel values for fuel that GCC's kilns are designed to utilize. GCC's kilns are all designed to utilize solid fuels, and each facility can additionally utilize liquid and/or gaseous fuels. Table 1 documents the traditional solid fuel range of values and lists the liquid and gaseous fuel values for constituents that have concentrations above the high end of the range for solid fuels.

Analytical results from Wind Turbine Blade Fuel show that the blade material is a beneficial replacement for traditional fuels in GCC's cement kilns. Sulfur content is typically very low. Chlorine content is such that the material will work efficiently in some, but not all cement manufacturing processes, similar to experiences with solid traditional fuel. Mineral content of the ash component has high concentrations of silica, calcium, and alumina, all of which are beneficial components in the cement manufacturing process. Minerals detrimental to cement manufacturing are negligible. Alkalis are lower than those for many traditional solid fuels.

Testing for the volatile and semi-volatile organic compound group are still being conducted. These results will be submitted as a separate attachment upon completion. From the Safety Data Sheets (SDS) on the ingredients that makeup the wind turbine blades, the volatile and semi-volatile content are expected to be lower than traditional fuels.

² Compilation of information from USEPA's Contaminant Concentrations in Traditional Fuels: Tables for Comparison (11/29/2011), and the Materials Characterization Paper (2/7/2011).

- C. The storage and materials management for Wind Turbine Blade Fuel at all phases from generation to the point of combustion meet the requirements of (40 CFR §241.3)(c)(1)(iii) and (40 CFR §241.3(d)(1)(i)(A)).
 - 1. Wind turbine blade material is only accumulated at the wind farm until transportation arrangements can be made to ship the blades to the receiving/processing facility. Typical storage time is projected to be less than a couple of months from the time of generation to the time the wind turbine blade is shipped. Distribution occurs by truck or rail, and the material is weighed with weights recorded on a uniform bill of lading. Records of wind turbine blade receipts are recorded and retained. The wind turbine blade is subject to regular sampling and laboratory analysis by the processing facility.
 - 2. Processed Wind Turbine Blade Fuel is a solid material in loose bulk form with handling characteristics similar to low-density traditional solid fuels. Storage and management of processed Wind Turbine Blade Fuel at GCC facilities is comparable to storage and management of the traditional solid fuels at the same GCC facilities. Wind Turbine Blade Fuel is delivered in trucks with dump trailers or walking floor trailers, or by rail. Incoming material is weighed, and weights are compared to weights on the bill of lading. Material is accounted for in accordance with inventory management practices established for other bulk solid fuel and raw material at the combustion facility. Inventory is valued on a first-infirst-out basis. Inventories commonly contain a supply sufficient for 30-90 days of operation, but in no case longer than one year. Inventory time frame is comparable to the time frame in EPA's speculative accumulation concept in RCRA and is consistent with GCC's solid traditional fuels inventory management time frames.
- D. In accordance with 40 CFR §241.3(d)(1)(B) and (C) Wind Turbine Blade Fuel is handled in a manner like that for traditional solid fuel to prevent releases to air, water or land.
 - TCLP analyses show that VOC, SVOC, and metal leachates from Wind Turbine Blade Fuel are well below RCRA limits and well below typical values for traditional solid fuels. Risk of airborne releases is like the risk of airborne releases from traditional solid fuel with mixed particle size.
 - 2. At the processing facility, wind turbine blade fuel production, transfer, storage, and loading are conducted in a way that minimizes air-borne and water-borne dispersion. Trucks transporting wind turbine blades are not covered as the wind turbine blades have been exposed to the elements for years. During processing, airborne releases are controlled by enclosed process equipment or with water mist. Rainwater releases are controlled in accordance with a storm water management plan. The processing site is designed to meet its NPDES permit. Fugitive air emissions are governed by air permit requirements, with controls similar to traditional solid fuels.

- 3. At the combustion facility, rainwater releases from the wind turbine blade fuel management area at the GCC facilities are controlled by an NPDES storm water permit. Fugitive air emissions are governed by the Title V air permit requirements, and Title V permits are held when required. Air emissions controls comparable to controls used for traditional solid fuels are in place.
- 4. Non-conforming material that is identified after incoming Wind Turbine Blade Fuel has been accepted by the GCC combustion facility is evaluated in accordance with Solid Waste regulations and treated in a manner appropriate to the material type. In general, non-conforming material is isolated from Wind Turbine Blade Fuel and is isolated from other consumable materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility, and is held only as long as necessary to arrange for proper disposition as outlined below.

Non-conforming, non-waste material is, when possible, used in another part of the process at the combustion facility if the non-waste material meets the definition of, and conforms to the specifications of, a non-hazardous secondary material fuel or ingredient that is already qualified for use at the combustion facility AND is already used at the combustion facility. In this case, "non-conforming material" refers only to material that does not conform to the specifications of Wind Turbine Blade Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that non-conforming material to the correct inventory, and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility, it will be transferred or disposed of as appropriate.

Non-conforming, non-hazardous material that is identified as solid waste is delivered to a landfill that accepts the type of waste. Non-conforming, non-hazardous material that is identified as non-hazardous liquid waste, non-hazardous semisolid waste or non-hazardous contained gaseous waste is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

Non-conforming hazardous waste material that is identified is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the type of waste identified, and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

E. Other Relevant Factors

 Use of wind turbines to generate utility-scale power has become widespread in recent years. The typical service life of a wind turbine blade is approximately 20 years from time of

installation. Wind turbine blades on existing turbine structures are replaced with new blades at the end of their useful service life. Because the proliferation of wind power generation is a recent phenomenon, recycling of wind turbine blade is relatively new technique. Wind turbine blade recycling is preferred over disposal and wind turbine blade material is not readily reused or repurposed.

 Wind turbine blade manufacture is a well-developed industry and the fabrication of wind turbine blades requires rigid adherence to design specifications. The composition of wind turbine blades and the abundance of the product indicate that recycling as fuel in cement kilns is a viable innovation.



Table 1: Fuel Specification & Comparison of Wind Turbine Blade Fuel to Traditional Fuel Tables

Chemical Name	CAS	Units	Wind turbine blade Fuel Typical	Coal Range EPA/OAQPS Database	Liquid Traditional Fuel Range (ppm)	Coal Trad. Spec (ppm)	Liquid Trad. Fuel Spec (ppm)	Comparison of Wind turbine blade Fuel to Coal and Liquid Fuel
				Metal Elements, ppm - dry basis	ppm - dry basis			
Mercury (Hg)	7439-97-6	mg/kg	<0.1	ND-3.1		3.1		Lower than coal
Cadmium (Cd)	7440-43-9	mg/kg	<5.0	ND-19				Lower than coal
Lead (Pb)	7440-92-1	mg/kg	<5.0	ND-148				Lower than coal
Selenium (Se)	7782-49-2	mg/kg	<5.0	ND-74.3				Lower than coal
Arsenic (As)	7440-38-2	mg/kg	6.01	ND-174		174		Lower than coal
Antimony (Sb)	7440-36-0	mg/kg	<5.0	ND-10				Lower than coal
Beryllium (Be)	7440-41-7	mg/kg	0.76	ND-206				Lower than coal
Chromium (Cr)	7440-47-3	mg/kg	13.1	ND-168				Lower than coal
Cobalt (Co)	7440-48-4	mg/kg	<20.0	ND-30				Lower than coal
Manganese (Mn)	7439-96-5	mg/kg	26.0	ND-512				Lower than coal
Nickel (Ni)	7440-02-0	mg/kg	<5.0	ND-730				Lower than coal
				Non-metal Elements, ppm - dry basis	5, ppm - dry basis			
Chlorine (CI)	7782-50-5	mg/kg	7210	ND-9080				Lower than coal
Fluorine (F)	7782-41-4	mg/kg	<20	ND-178				Lower than coal
Nitrogen	7727-37-9	mg/kg	NA	13,600-54,000	ND-150,000	005'29		Lower than coal
Sulfur (S)	7704-34-9	mg/kg	1020	740-61,300	ND-150,000	76,625	187,500	Lower than coal
			Volatil	e Organic Compound	Volatile Organic Compounds (VOC), ppm - dry basis			
Benzene	71-43-2	mg/kg	*	ND-38.6	ND-75	38.6	75	
Ethylbenzene	100-41-4	mg/kg	*	0.7-5.4	22-1,270			
Styrene	100-42-5	mg/kg	*	1.0-26	ND-320			
Toluene	108-88-3	mg/kg	*	8.6-56	ND-380			
Cumene	98-82-8	mg/kg	*		6,000-8,600			
Formaldehyde	20-00-0	mg/kg	*	1.6-2.7				
Hexane	110-54-3	mg/kg	*		50-10,000			
Phenol	108-95-2	mg/kg	*		ND-7,700			
Xylenes	1330-20-7	mg/kg	*	4.0-28	ND-3,100			
Naphthalene	91-20-3	mg/kg	*		ND-7,330			
Biphenyl	92-52-4	mg/kg	*		1,000-1,200			
Polycyclic		- Variable	*	9000	000 54 700	X		
liyal ocal bolls		IIIB/NB		14-4070	3,900-54,/00			

* Still being tested. Results will be provided upon completion of testing

I. Introduction:

- A. This document shows that the Mixed Plastic Fuel to be utilized as alternative fuel by GCC meets the definition of Non-Hazardous Secondary Material (NHSM) fuel as described at 40 CFR 241. Mixed plastics may be referred to in other literature as mixed-grade plastics, comingled plastics, single-stream plastics, non-recyclable plastics and recyclable plastics, or Grade "n" through Grade "m" plastics, where "n" and "m" are integers 1 through 7 that identify plastics by makeup. Mixed plastics may also be referred to by other names from time to time. The following sections describe the fuel derived from mixed plastics and how the material meets NHSM regulations as a non-waste fuel. The Process Description section in the NHSM Management Manual contains a description of the cement manufacturing process, documents how the AF is used to replace fossil fuels, and the benefits of using AF from an environmental standpoint.
- B. GCCs alternative fuel processing facilities will receive mixed plastics from three types of sources. These sources include manufacturers who produce quantities of plastic as manufacturing byproducts or coproducts, commercial enterprises that aggregate large quantities of non-comingled plastics for distribution, and municipal recovery facilities (MRFs) that receive mixed recyclable material as a single stream that is not commingled with other materials delivered to or received by the MRF, such as municipal waste (MRF's).
- C. Source facilities are evaluated and selected based on their ability to demonstrate the technical, operational, and administrative capacity to adequately guarantee product control. After selection, sources are subject to regular audits to assure continued compliance with established performance standards.
 - 1. In cases where the source material is generated from manufacturing processes, the source material must be collected at the point of generation and transferred to storage at the source facility. The source material maybe mixed or comingled only with similar material originating from the same facility. Source materials may not be mixed or commingled with trash, refuse, contaminants, or any other materials that do not fit the description of mixed plastics. The source material cannot have been recovered from refuse at the generator facility. Manufacturing co-products include HDPE tubing scraps, printer toner cartridge manufacturing scraps, trimmings from the manufacture of consumer goods and plastic extrusions. Manufacturers are held to performance standards through contractual arrangements. Due to the selection process, industrial or manufacturing source material requires minimal processing.
 - Large commercial sources as generators (Commercial Generators) are subject to binding
 performance contracts. The contract terms stipulate non-waste status of source material
 and require the Commercial Generator to certify non-waste source material status. The

¹ Scott Bowen, "Taking Them Back: How Recycling Toner Containers Help the Planet," Forbes, last modified August 10, 2017, accessed January 4, 2019, https://www.forbes.com/sites/kyocera/2017/08/10/taking-them-back-how-recycling-toner-containers-help-the-planet/#490c4f8fb065

contract terms also defines product control from the point of generation, control of inventories, rejection of hazardous waste or solid waste, isolation from contaminants, and consistency of product makeup. Commercial Generators are evaluated in accordance with the Recycling Industry Operating Standard® (RIOS®) Quality, Environmental, Health and Safety (QEHS) Management System.² Because of the selection process, source material received from Commercial Generators requires minimal processing.

3. Municipal or small commercial recovery facilities (MRFs) that isolate recyclable materials from single-stream recycling form the third classification of the mixed plastic source. Single-stream recycling, or fully commingled recycling, is widely used across the United States and refers to a system where multiple grades of paper, cardboard, fiberboard, plastics, glass, aluminum, and steel are collected as a single stream.³ In 2015, about 68 million tons of single stream material was recycled and this number is continuing to grow.⁴

Mixed plastics from MRFs require sufficient processing to meet the NHSM requirements. Prior to processing, plastics from single-stream recycling are not suitable for use as kiln fuel. The plastics are a portion of a highly heterogeneous commingled mixture with many other materials such as metal, glass, cardboard, paper (which may be water saturated), food waste, hazardous waste, sand, and dirt. Prior to use as a fuel, mixed plastics require significant separation and processing to isolate combustible materials with significant heat values, low ash contents, and low contaminant concentrations.

MRFs are equipped with complex and sophisticated sorting and processing systems to efficiently separate components such as aluminum, steel, and copper; all of which have the highest values in recycled material markets, and therefore the highest recycling rates. In the material recovery process, plastics are separated from other materials. Depending upon several factors, such as total volume, value in downstream markets, and access to end use markets, plastics might be further separated by grade. This document will demonstrate that the source material received from recovery facilities meets the "sufficiently processed" criteria and requires minimal further processing..

D. Mixed plastics are mixtures of various polymeric plastic compounds that are graded by type according to their suitability for consumer, commercial, industrial, or manufacturing uses.

² RIOS® Certification for Recyclers, http://www.rioscertification.org/, accessed April 1, 2019.

³ United States Environmental Protection Agency, Advancing Sustainable Materials Management: 2015 Fact Sheet, by U.S. EPA, 4, July 2018, accessed January 4, 2019, https://www.epa.gov/sites/production/files/2018-07/documents/2015 smm msw factsheet 07242018 fnl_508_002.pdf.

⁴ United States Environmental Protection Agency, Advancing Sustainable, 2.

⁵ David Rachelson, "What is Recycling Contamination and Why is it Important?," Rubicon, last modified December 4, 2017, accessed January 4, 2019, https://www.rubiconglobal.com/blog-recycling-contamination/.

⁶ USEPA, Advancing Sustainable Materials Management: Facts and Figures Report, "Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States", July, 2018.

Plastics are commonly assigned a Grade number from 1 to 7 which broadly identifies the chemical makeup as well as the most common uses of each plastic type.⁷

Grade 1: Polyethylene Terephthalate (PET) — Commonly used for food and drink packaging as well as textiles; recyclable; repurposed to make textiles, carpets, pillow stuffing, life jackets, storage containers, clothing, boat sails, auto parts, sleeping bags, shoes, luggage and winter coats. PETE plastics make up 96% of all plastic bottles and containers in the U.S.

Grade 2: High Density Polyethylene (HDPE) -- Commonly used for opaque packaging such as grocery bags, milk jugs, butter containers, etc., or for piping and semi-rigid tubing; recyclable; repurposed to make plastic crates, lumber and fencing. HDPE is the most commonly recycled plastic because it will not break under exposure to extreme heat or cold.

Grade 3: Polyvinyl Chloride (PVC) -- Commonly used for toys, wrapping and non-food contact materials; repurposed to make flooring and mobile home skirting. Generally, less than 1% of PVC plastic is recycled each year.

Grade 4: Low Density Polyethylene (LDPE) — Commonly used for film applications such as cleaner bags, wrapping, etc.; recyclable; repurposed to make garbage cans and lumber. Packaging and containers made from LDPE make up about \$6% of all plastic waste

Grade 5: Polypropylene (PP) -- Commonly used in food containers, car parts, etc.; recyclable; repurposed to make ice scrapers, rakes and battery cables. Only about 3% of polypropylene products are recycled in the U.S.

Grade 6: Polystyrene (P5) -- Commonly used in Styrofoam food containers and as a rigid casting for all types of appliance parts, etc.; recyclable; repurposed to make insulation, license plate frames or rulers. Polystyrene accounts for about 35% of U.S. landfill materials.

Grade 7: All other plastics including Polycarbonate (PC) — Commonly used in bottles and packaging as well as DVD discs. Some type 7 plastics such as Polycarbonate are not recyclable but can be repurposed to make plastic lumber (which is often used in outdoor decks, molding, and park benches); many BPA products fall into this category. It is difficult to break down these plastics once they are created, unless they are exposed to high temperatures.

E. Mixed Plastic Fuel may be made up of all grades commingled, have a higher representation of Grades 2-7 or 3-7, or other combinations depending on current market forces. The overall makeup of the mixture will vary somewhat over time but it is highly homogeneous and consistent in the short term as required for a fuel. Grades 1 and 2 are the most commonly used and recycled plastics and therefore are the most likely to be isolated from the product stream.⁸

⁷Alyssa Mertes, "Types of Plastic and Their Recycle Codes," Quality Logo Products, accessed January 4, 2019, https://www.qualitylogoproducts.com/promo-university/different-types-of-plastic.htm.

⁸ Amanda Wills, "The Ultimate Plastic Breakdown," Earth911, last modified November 23, 2009, accessed January 7, 2019, https://earth911.com/eco-tech/the-ultimate-plastic-breakdown/.

Grade 1 plastic is the most readily isolated plastic in post-consumer material streams, therefore it has the lowest recovery cost and is the most likely to be isolated for beneficial reuse. The price per ton for virgin Grade 1 plastic varies, but on the high end it is priced in the hundreds of dollars. The price per ton for all other mixed plastics is in the \$50-\$100 per ton range at a 2018 market value. Grade 2 plastic is the most recycled plastic because it is considered one of the safest forms of plastic. Recycling grade 2 plastic for secondary use is a simple and cost-effective process. Grades 3 and 4 may be recycled or repurposed into a number of different products such as flooring, mobile home skirting, garbage cans and lumber. Grades 5-7 are not considered recyclable but are repurposed as ice scrapers, rakes, battery cables, insulation, license plate frames, rulers, and plastic lumber. Post-industrial and post-manufacturing co-products are most commonly made up of Grades 4-7 plastics. Grade 7 plastics are widely used in manufacturing and are the most highly varied. They include acrylics, styrenes, butadienes, polycarbonates, and many other derivatives.

F. Mixed Plastics Fuel is a low-density homogeneous solid with mixed particle size. The Mixed Plastic Fuel may have some insignificant residual quantity of paper, cardboard, fiber, or glass. The plastic particles are mostly two-dimensional pieces with some three-dimensional pieces mixed in. Plastics are not generally friable, so there is a limited content of very fine material. The material is shredded to produce a uniform maximum particle size. The pieces formed in the shredding process have well defined edges and the bulk material flows freely, handles easily, and does not tend to agglomerate. After processing, mixed plastic is a valuable fuel for cement kilns because it is easy to handle, performs well in solid fuel feed systems, is amenable to mechanical or pneumatic conveying, has good combustion characteristics, a high heat value, and a low tendency to produce pollutants.

II. NHSM Determination Criteria

- A. Mixed Plastic Fuel is sourced, separated, processed, transported and stored in a way that identifies it as a valuable commodity (40 CFR §241.3)(c)(1)(i). When not used as fuel, the components of mixed plastic can be either recycled or repurposed when isolated. A mixture of all available component plastic grades, as opposed to segregated streams of plastic grades, provide more homogeneous fuel quality over time.
 - SOURCE CONTROL Generators of mixed plastics fall into three general categories. One, industrial or manufacturing facilities that generate manufacturing co-products or byproducts where source material is isolated at the point of generation with the intent of

⁹ Greg Seaman, "Plastics by the Numbers," Earth Easy, last modified May 2, 2012, accessed January 7, 2019, https://learn.eartheasy.com/articles/plastics-by-the-numbers/.

¹⁰ Daniel Poolen, "What Can the Prices of Plastics Teach Us?," Plastic Soup Trip, accessed January 7, 2019, http://www.plasticsouptrip.com/post/97791290765/what-can-the-prices-of-plastics-teach-us.

¹¹ Seaman, "Plastics by the Numbers," Earth Easy.

¹² Mertes, "Types of Plastic," Quality Logo Products.

¹³ Ihid

¹⁴ Seaman, "Plastics by the Numbers," Earth Easy.

recycling or repurposing (Industrial Generators). Two, commercial-scale sources that aggregate and distribute large quantities of sorted, non-comingled plastics to supply the commodities market with clean, recyclable material (Commercial Generators). Three, post-consumer facilities where plastics are recovered from streams of from incoming recyclable material (MRFs).

Prior to selection as a supplier of source material, generators must demonstrate the technical, operational, and administrative capacity to adequately guarantee product control. Generators are expected to have established written acceptance and rejection standards, adequate management structure, staffing for effective operation, mechanical and administrative means to assure product control, and facilities that conform to accepted norms of operation and comply with legal and environmental standards. After selection, generators are subject to regular audit to assure continued adherence to the established performance standards.

In cases where source material is obtained from Industrial Generators or Commercial Generators, generator performance is managed under contractual relationships. The contract terms stipulate non-waste status of source material and require the Generator to certify non-waste source material status. The contract terms also stipulate product control from the point of generation, control of inventories, rejection of hazardous waste or solid waste, isolation from contaminants, and consistency of product makeup.

In the case of post-consumer materials, isolated recyclable materials from comingled or non-comingled streams are processed at recovery facilities (MRFs). The recovery of multiple beneficial products is a well-established practice across the United States with nearly 4,000 different municipal recycling facilities with 800 MRFs managing 73-million tons of recycled material operating in the U.S. by 2013.¹⁵ Post-consumer material recycling requires that materials processed be suitable for reentry into the recycled raw material stream to be used in consumer product manufacturing. Collection and delivery practices are in place to exclude materials identified as general refuse, solid waste, or hazardous waste.¹⁶ In order to be considered as suppliers of mixed plastic source material for GCC, MRFs must demonstrate the same standards of material acceptance and rejection as commercial sources. Further, MRFs must employ sorting and cleaning equipment similar to that described in the section of this document under Section II.A.2 "Material Management and Processing at MRFs."

2. MATERIAL MANAGEMENT AND PROCESSING AT MRFs

¹⁵ Environmental Research and Education Foundation, "Municipal Solid Waste Management in the U.S.: 2010 and 2013," published 2016.

¹⁶ Waste Management, "Single Stream Specifications," Waste Management, accessed January 8, 2019, https://www.wm.com/recycling-services/pdfs/SingleStream.pdf.

a. RECIEPT OF MATERIALS: Recyclable materials from established collection routes or from centralized collection points are dropped off by truck. Pick-up and drop-off of comingled recyclables is typically by done with front-end packers, compactor roll-offs, or covered roll-offs.¹⁷ Vehicles are enclosed to minimize air-borne and water-borne dispersion.

Materials are generally delivered to a single point, commonly referred to as the "tipping floor," and then transferred to a conveyor system in preparation for sorting. Materials receipt is managed by personnel trained to recognize non-recyclable materials, hazards, waste materials, or prohibited materials. Incoming shipments will first go through a presort stage in which MRF workers will inspect and manually remove any non-recyclable materials such as general waste items, electronic waste, hazardous materials, or other excluded items. They may also remove larger recyclable items such as plastic drums, washing baskets, toys, and steel items for manual sorting. Incoming shipments that contain excessive prohibited materials are rejected. The remaining accepted material will be conveyed to the main sorting stages.¹⁸

- b. REMOVAL OF CONTAMINANTS: MRF workers manually inspect materials on the conveyor system to ensure that any non-recyclable materials or contaminants do not move on to any further screening. During sorting and screening, materials soaked in any sort of hazardous waste are discarded by measuring the differing weight and density of the material. Some specific "wet" MRFs are facilities designed to densify, separate, and clean output streams, resulting in the dissolving of any biodegradable organics.¹⁹
- c. SORTING OF MATERIALS: Materials are sorted using a combination of separation methods, most often including conventional screening, pneumatic separation, magnetic separation, and eddy current or induction separation. The sorting phase commonly begins with coarse shredding for size reduction. Consistent maximum particle size facilitates further manual and mechanical separation. At the start of the sorting phase, materials are fed using metering drum or paddle to achieve consistent flow and regulate the amount of material which is fed into the next sorting stage.²⁰
 - Nearly all sorting stages begin with some type of screening. The screen type is designed to achieve the most effective separation with a given product type. Star

¹⁷ CalRecovery Inc., Final Environmental Assessment of Materials Recycling Facility for County of Kauai (Concord, CA: CalRecovery Inc., n.d.), 9,

 $http://www.kauai.gov/Portals/0/PW_Recycling/MRF/Final\%20EA\%20 for \%20 MRF\%20 to \%20 Cty\%20 for \%20 submission.pdf?ver=2017-02-01-142122-240.$

¹⁸ Logan City Council, "Materials Recovery Facility (MRF)," logan.qld, accessed January 9, 2019,

https://www.logan.qld.gov.au/__data/assets/pdf_file/0004/129433/MRF.pdf.

¹⁹ Neil Porter, "Let me show you a new world, Bahrain- the MRF," blogspot.com, accessed February 22, 2019,

http://neilinbahrain.blogspot.com/2015/07/let-me-show-you-new-world-bahrain-mrf.html

²⁰ WasteMINZ, "Materials Recovery Facility," WasteMINZ, accessed January 9, 2019,

http://www.wasteminz.org.nz/wp-content/uploads/MRF-Guidelines-130730-consultation-document.pdf.

Screens are a type of sorting technology that are designed to separate light materials from heavier material types. A shaft fitted with a series of rotating star shaped discs works to propel the light materials (paper and cardboard) forward. Heavy materials (plastic, steel, glass and aluminum) travel backwards.²¹

Disc screens are flat screens that consist of an array of disks that spin on shafts. Disc screens move the materials across the screen by means of the disc rotation, which allows materials to be fed directly onto the screen. Disc screens are most effective when the fine material to be removed is denser than the larger materials.²²

Rotating cylindrical screens such as trommels that are inclined at a downward angle while the horizontal material is fed into the trommel at the elevated end and separated as it moves down. Diameter, rotation speed, inclination, and several other refinements are set to attain the desired outcome. In addition to providing good size separation, trommels are particularly effective in breaking up clumps of material that could reduce the effectiveness of other separation steps.²³

- ii. Air classification with table, rake, or cyclone classifiers is utilized to separate materials by size and density. Table and rake classifiers have been widely used in mineral processing. Cyclone separators are ubiquitous in industry for their simplicity and utility. Cyclone separators are used in material recovery to remove lighter separated materials. The cyclone uses a centrifugal action that results from the airflow moving materials to the walls of the separator. Heavier materials will slide down the walls to exit.²⁴
 - iii. Many MRFs will also utilize magnetic separators to remove ferrous materials from co-mingled recyclables. A magnetic field is formed between the ferrous metals and an overhead self-cleaning electromagnet or a permanent magnet. Gravity and the gap between the magnet and the materials restricts other materials from entering the product stream. Once removed, the ferrous materials can either be shredded or baled.²⁵

Electrostatic separation applies a static charge to materials passing through a static field. The surface properties of different plastic types cause different charges to be

²¹ Logan City Council, "Materials Recovery," logan.qld.

²² Alexander J. Dubanowitz, "Design of a Materials Recovery Facility (MRF)," Columbia.edu, last modified May 2000, accessed January 8, 2019, http://www.seas.columbia.edu/earth/wtert/sofos/dubanowitz_thesis.pdf. ²³ Ibid.

²⁴ Ibid.

²⁵ lbid.

retained by different grades of plastic. Electrostatic separation efficiently separates plastic by type and is used to separate PVC plastics from other plastics.²⁶

Optical sorting of plastics is widely used to separate plastics by grade. Optical sorting takes advantage of the spectrographic properties of different plastic types. It works by examining the light transmitted, absorbed, or reflected when a stream of plastic pieces is passed through a light beam of known wavelength. A spectrometer identifies a particle from its target spectrum and a computer determines the particle's location. The computer calculates the particle's position as it passes through a network of air jets, which then fire precisely to blast the particle into the correct exit stream. In order to work efficiently, the material is fed onto a high-speed conveyor in a stream thin enough to prevent layering or stacking of particles.

- d. FINAL MRF STAGE: Once materials are sorted, they are baled or stacked on site to await transport off site. In the case of bulk re-usable materials, goods may be moved around the site to meet storage needs of the facility.²⁷
- 3. FINAL PROCESSING OF MIXED PLASTICS USED AS FUEL: Mixed plastic received from the generator may arrive in loose bulk form, baled and palletized, cubed, bagged or otherwise packaged. Processing, if required at this final stage, consists of shredding and screening using conventional shredding equipment plus blending and homogenizing to achieve product consistency. The mixed plastic is sized and screened to meet particle size requirements for the combustion facility's feed equipment design. Sieve analysis performed to meet the specifications established by the combustion facility is used to determine the extent of this final processing requirement. Following this final processing step, the mixed plastic takes the form of Mixed Plastic Fuel.
- 4. HANDLING EN ROUTE TO THE COMBUSTION FACILITY: The Mixed Plastic Fuel is delivered to the combustion facility in roll-offs, walking floor trailers, end dump trailers, shipping containers or pneumatic trailers. Open trailers used to transport Mixed Plastic Fuel are covered to prevent loss of material during transit.

Non-conforming material that is identified after the incoming mixed plastic source material or Mixed Plastic Fuel has been accepted by the GCC processor or combustion facility is evaluated in accordance with South Dakota regulations under the definition of Solid Waste in SDCL: 34A-6-1.3(17) and treated in a manner appropriate to the material type.

Nonconforming material is isolated from mixed plastic source material and Mixed Plastic

²⁶ H. Daiku, T. Inoue, M. Tsukahara, H. Maehata and K. Kakeda, "Electrostatic separation technology for waste plastics-development of a high-purity type separator for plastics," Proceedings Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing, Tokyo, Japan, 2001, pp. 562-565. doi: 10.1109/ECODIM.2001.992424.

²⁷ WasteMINZ, "Materials Recovery Facility," WasteMINZ, accessed January 9, 2019, http://www.wasteminz.org.nz/wp-content/uploads/MRF-Guidelines-130730-consultation-document.pdf.

Fuel, and is isolated from other consumable materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility and is held only as long as necessary to arrange for proper disposition as outlined below.

When possible, a *Non-conforming, nan-waste material* is used in another part of the process at the combustion facility if the non-waste material meets the definition and conforms to the specifications of a NHSM fuel or ingredient *that is already qualified for use at the combustion facility AND is already used at the combustion facility.* In this case, "non-conforming material" refers only to material that does not conform to the specifications of mixed plastic source material or Mixed Plastic Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that non-conforming material to the correct inventory and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility it will be transferred or disposed of as appropriate.

Non-conforming material that is identified as *non-hazardaus solid waste* is delivered to a landfill that accepts the type of waste. Non-conforming material that is identified as *non-hazardous liquid waste*, *non-hazardous semisolid waste* or *non-hazardous contained gaseous waste* is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

Non-conforming material that is identified as *hazardous waste* is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the type of waste identified, and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

5. SUMMARY OF THE "PROCESSING CRITERIA": Mixed Plastic Fuel meets the requirement of sufficient processing as supported by process descriptions used in the NSHM used as a fuel determination²⁸ based on contaminant removal, management, and sufficient processing. Mixed Plastic Fuel meets the requirement of sufficient processing as supported by process descriptions used in the non-waste determination for processed oil filter fluff ²⁹ based on contaminant removal and sufficient processing. The materials used to make mixed plastic fuel are under rigid source control. Material reception protocols include mechanical and visual examination to reinforce material exclusion. Contaminants are removed by mechanical and manual means prior to processing. Mixed plastic is prepared for fuel use by separation and processing to isolate the combustible materials with low ash content and

²⁸ Non-Waste Determinations for Specific Non-Hazardous Secondary Materials When Used as a Fuel., 40 C.F.R. § 241.4 (a)(5)(i), (ii) and (iii) (2018).

²⁹ United States Environmental Protection Agency (EPA), 2011-06-30 "Waste Determination For Oil Filter Fluff That Is Burned In Combustion Units" letter to Trendgreen Associates.

low contaminant concentrations. Initial processing is done by the generator using a combination of mechanical sorting by size and density, air classification, induction separation, optical separation and magnetic separation. The treatment of exclusion and sorting by the collection facility and generator of mixed plastics is similar to the requirements for positive and negative sorting, and training, in the Categorical Exclusion of C&D wood processed from C&D debris³⁰, and in the non-waste determination for SpecFUEL.³¹ The selection, exclusion, sorting, and processing steps to produce mixed plastic fuel are nearly identical to the steps described in the non-waste determination of Roaring Spring Biofuel "fuel cubes"³² and highly similar to the processing steps and general makeup of the material described in the non-waste determination of Greenwood Fuels LLC "fuel pellets".³³

- B. The following section and corresponding table provides documentation that the chemical and physical identity of Mixed Plastic Fuel is comparable to commercial fuels (40 CFR §241.3)(c)(1)(ii), that Mixed Plastic Fuel have a meaningful heating value when used in a unit that recovers energy (40 CFR §241.3(d)(ii), and that Mixed Plastic Fuel has contaminants that are comparable to or less than traditional fuels (40 CFR §241.3(d)(iii).
 - MEANINGFUL HEAT VALUE The processed mixed plastic has a significant fuel value. Calorimetry of mixed plastic samples show that the material has gross heating values in the range of 12,000 – 17,000 Btu/lb on an as-received basis; greater than 5,000 Btu/lb, as fired threshold (76 FR 15541, March 21, 2011). The mixed plastic makes a useful contribution to the cement clinker manufacturing process which inherently requires substantial heat input.
 - 2. CONTAMINANT COMPARISON Table 1 compares contaminants of mixed plastic with those of the traditional fuel values for fuel that GCC's kilns are designed to utilize. GCC's kilns are all designed to utilize solid fuels, and each facility can additionally utilize liquid and/or gaseous fuels. Table 1 documents the traditional solid fuel and liquid fuel range of values. A comparison to liquid fuel is made because of one contaminant (formaldehyde) detected in samples of plastic that is not reported in the databases of traditional solid fuel.

Analytical results from mixed plastic show that it is a beneficial replacement for traditional fuels in GCC's cement kilns. Contaminant ranges for many contaminants are lower than contaminant ranges for solid fuels by an order of magnitude or more. In the case of naphthalene, which is not reported for traditional solid fuels, is approximately three orders

³⁰ Non-Waste Determinations for Specific Non-Hazardous Secondary Materials When Used as a Fuel., 40 C.F.R. § 241.4 (2018).

³¹ Letter by Barnes Johnson, "Non-waste determination for SpecFUEL," n.d., accessed December 20, 2018, https://archive.epa.gov/epawaste/nonhaz/define/web/pdf/specfuel.pdf.

³² United States Environmental Protection Agency (EPA), 2013-02-06 "non-waste determination for fuel cubes" letter to Roaring Spring Biofuel.

³³ United States Environmental Protection Agency (EPA), 2011-11-14 "non-waste determination for fuel pellets" letter to James S. Rickrun Environmental Consulting.

of magnitude lower than values reported for traditional liquid fuel. Polycyclic hydrocarbons detected in samples of mixed plastic, were lower than the upper limit for traditional solid fuels and nearly two orders of magnitude lower than the lower limit for traditional liquid fuels. Chlorine and fluorine levels are lower than comparable traditional fuel values by statistically significant amounts. Nitrogen content is approximately half of that for traditional solid fuel. Comparable volatile organic compounds (VOCs) are generally below the low end of the VOC range in traditional solid fuel, some by an order of magnitude or greater.

Four compounds in the volatile organic compound group were detected in samples of mixed plastic that are not reported in databases for traditional fuel, at very low concentration.

- a. Trichlorofluoromethane was detected at levels as high as 500 mg/kg, although typical levels were considerably lower. Prior to 1996, trichlorofluoromethane was widely used as a low-pressure refrigerant, as an industrial solvent, as a propellant in aerosol cans, and in the production of Styrofoam.³⁴ It is commonly referred to as Refrigerant-11, Freon-11 or Fluorocarbon- 11.³⁵ There has been recent indication that trichlorfluoromethane is still being manufactured and used as a blowing agent in parts of central Asia.^{36,37}
- b. 1,1,2-trichloro-1,2,2-trifluoroethane was detected at 3.00 mg/kg in one sample. 1,1,2-trichloro-1,2,2-trifluoroethane is used in freezing foods and has been used as a cooling agent in refrigerants and air conditioners, aerosol propellant, and a cleansing agent for electrical and electronic components.³⁸ It is commonly referred to as CFC-113, Freon 113, and Refrigerant 113.³⁹ Although contact with CFC- 113 has been shown to irritate any part of the body exposed to the chemical, it is not expected to pose any risk at the levels reported for mixed plastics.⁴⁰
- Trichloroethane was detected at 5.50 mg/kg in one sample. Prior to the Montreal
 Protocol, trichloroethane was widely used for cleaning metal parts and circuit boards, as

³⁴ National Center for Biotechnology Information, "Trichloromonofluoromethane," PubChem Compound Database, https://pubchem.ncbi.nlm.nih.gov/compound/6389#section=MeSH-Entry-Terms. 35 Ibid.

³⁶ Stephen A. Montzka, "An unexpected and persistent increase in global emissions of ozone-depleting CFC-11," nature SS7 (May 16, 2018): 413, accessed December 20, 2018, https://doi.org/10.1038/s41586-018-0106-2.
37 David E. Oram, "A growing threat to the ozone layer from short-lived anthropogenic chlorocarbons," Atmospheric Chemistry and Physics, 11929th ser., June 2017, 17, https://doi.org/10.5194/acp-17-11929-2017.
38 National Center for Biotechnology Information, "1,1,2-Trichlorotrifluoroethane," PubChem Compound Database; CID= 6428, https://pubchem.ncbi.nlm.nih.gov/compound/6428#section=Synonyms.
39 The National Institute for Occupational Safety and Health, "1,1,2-Trichloro-1,2,2-trifluoroethane," Centers for Disease Control and Prevention (CDC), accessed December 27, 2018, https://www.cdc.gov/niosh/npg/npgd0632.html.

⁴⁰ New Jersey Department of Health, 1,1,2-trichloro-1,2,2-trifluoroethane, 1, June 2000, accessed December 27, 2018, https://nj.gov/health/eoh/rtkweb/documents/fs/1904.pdf.

a photoresist solvent in the electronics industry, as an aerosol propellant, as a cutting fluid additive, and as a solvent for inks, paints, adhesives and other coatings. 1,1,1-Trichloroethane, Methylchloroform, and Inhibisol are a few other common names for Trichloroethane. It has been shown to irritate skin, eyes, and mucous membranes upon contact. It is nonflammable but may emit toxic fumes if exposed to high temperatures. However, it is not expected to pose any risk at the levels reported for mixed plastics. 41

- d. Dibromomethane is detected at concentrations below 1.0 mg/kg. Dibromomethane is commercially used as a solvent or as a gauge fluid⁴², and is naturally produced by marine algae.⁴³ Dibromomethane may be harmful in quantities large enough to inhale or swallow,⁴⁴ but is not expected to be a concern at the minute quantity detected.
- C. The storage and materials management of mixed plastic at all phases from generation to the point of combustion meet the requirements of (40 CFR §241.3)(c)(1)(iii) and (40 CFR §241.3(d)(1)(i)(A)).
 - 1. Mixed plastic is not accumulated in any significant quantity or for any significant period of time at any generator facility, at the processor, or at the combustion facility. Typical storage time by the generator is less than three months from the time of generation to the time the material is distributed. Storage time may vary seasonally depending on supply, market demand for recycled material, and logistical constraints. Commercial and industrial generators who ship by rail may be constrained by more competitive intermodal commodities. When mixed plastic source material or finished Mixed Plastic Fuel is shipped, it is weighed with weights recorded on a uniform bill of lading. Records of plastic distribution are recorded and retained. Mixed plastics are either sold as fuel or sold to commercial plastic manufacturers. Unsold plastic is often sent to a landfill.

Mixed Plastic Fuel is a solid material in loose bulk form with handling characteristics similar to low-density traditional solid fuels. Storage and management of Mixed Plastic Fuel at GCC facilities is comparable to storage and management of the traditional solid fuels that the same GCC facilities. Mixed Plastic Fuel is delivered by trucks with dump trailers or walking floor trailers. Incoming material is weighed and weights are compared to weights on the bill of lading. Material is accounted for in accordance with inventory management practices established for other bulk solid fuel and raw material at the combustion facility. Inventory is valued on a first-in-first-out basis. Inventories most commonly contain a supply sufficient for 30-180 days of operation, but in no case longer than one year. Inventory time frame is

⁴¹ National Center for Biotechnology Information, "Trichloroethane," *PubChem Compound Database*; CID= 6278, https://pubchem.ncbi.nlm.nih.gov/compound/1_1_1-trichloroethane.

⁴² National Center for Biotechnology Information, "Dibromomethane," *PubChem Compound Database*, https://pubchem.ncbi.nlm.nih.gov/compound/dibromomethane#section=Top.+
43 lbid.

⁴⁴ International Chemical Safety Card 0354 (ICSC:0354)

comparable to the time frame in EPA's speculative accumulation concept in RCRA and is consistent with GCC's solid traditional fuels inventory management time frames.

- D. In accordance with 40 CFR §241.3(d)(1)(B) and (C) mixed plastic is handled in a manner similar to that for traditional solid fuel to prevent releases to air, water or land.
 - 1. The NHSM collected for processing at MRFs is treated as a valuable commodity as defined by 40 CFR§241.3(d)(1)(B) and (C) from the time the materials are transported, unloaded, taken in as inventory, maintained and stored. Vehicles that pick-up and drop-off co-mingled recyclables are typically front-end packers, compactor roll-offs, or covered roll-offs. ⁴⁵ Vehicles are enclosed so as to minimize air-borne and water-borne dispersion. They are of adequate size to contain all material without any spillage and lack any deficiencies such as rusting, cracking, or any other deformities. Materials are generally delivered to a single point, commonly referred to as the "tipping floor" and transferred to a conveyor system in preparation for sorting. After sorting, material is stored separately in loose or baled piles far from contact with each other or any walls to reduce fire hazard, contamination or comingling.
 - Mixed plastics are highly stable in the environment and resistant to degradation that could lead to release of chemical constituents to air, land or water. Mixed plastic stability and resistance to decomposition also minimizes the likelihood of uncontrolled releases of particulates to air water or land.
 - 3. At the generator facility, mixed plastic collection, processing, transfer, storage, and loading is conducted in a way that minimizes air-borne and water-borne dispersion. Trucks transporting mixed plastics are covered to prevent airborne releases. During processing where there is a potential to create airborne releases, airborne releases are controlled by enclosed process equipment or with water mist. Rainwater releases are controlled in accordance with a storm water management plan. The generator site is designed to limit water infiltration of material, and any water generated on site is subject to the requirements of NPDES permit requirements or similar governing requirements. Fugitive air emissions are governed by air permit requirements or practices appropriate for the size and type of facility, with controls similar to traditional solid fuels.
 - 4. At the combustion facility, rainwater releases from the Mixed Plastic Fuel management area at the GCC facilities are controlled by an NPDES storm water permit. Fugitive air emissions are governed by the Title V air permit requirements and Title V permits are held when

⁴⁵ CalRecovery Inc., Final Environmental Assessment of Materials Recycling Facility for County of Kauai (Concord, CA: CalRecovery Inc., n.d.), 9,

http://www.kauai.gov/Portals/0/PW_Recycling/MRF/Final%20EA%20for%20MRF%20to%20Cty%20for%20submiss ion.pdf?ver=2017-02-01-142122-240.

required. Air emission controls comparable to controls used for traditional solid fuels are in place.

5. Non-conforming material that is identified after the incoming mixed plastic source material or Mixed Plastic Fuel has been accepted by the GCC processor or combustion facility is evaluated in accordance with South Dakota regulations under the definition of Solid Waste in SDCL: 34A-6-1.3(17) and treated in a manner appropriate to the material type. In general, non-conforming material is isolated from mixed plastic source material and Mixed Plastic Fuel, and is isolated from other consumable materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility, and is held only as long as necessary to arrange for proper disposition as outlined below.

When possible, Non-conforming, non-waste material is used in another part of the process at the combustion facility if the non-waste material meets the definition of, and conforms to the specifications of, a NHSM fuel or ingredient that is already qualified for use at the combustion facility AND is already used at the combustion facility. In this case, "non-conforming material" refers only to material that does not conform to the specifications of Mixed Plastic Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that non-conforming material to the correct inventory, and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility, it will be transferred or disposed of as appropriate.

Non-conforming material that is identified as *non-hazardous solid waste* is delivered to a landfill that accepts the type of waste. Non-conforming material that is identified as *non-hazardous liquid waste*, *non-hazardous semisolid waste*, *or non-hazardous contained gaseous waste* is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

Non-conforming material that is identified as *hazardous waste* is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the type of waste identified, and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

SDCL: 34A-6-1.3(17) "Solid waste," any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include mining waste in connection with a mine permitted under Title 45, hazardous waste as defined under chapter 34A-11, solid or dissolved materials in domestic sewage or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under

section 402 of the Federal Water Pollution Control Act, as amended to January 1, 2011, or source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended to January 1, 2011;

E. Other relevant factors

- 1. Certain grades of mixed plastics are widely recycled, however, even in the case of readily recyclable grades 1 and 2 plastics the manufacture of new plastics far outpaces the rate of recycling. 46 Overall, in 2015 just 9.1 percent of all plastic was recycled. 47 Total generation of plastic in the United States was 34.5-million tons, of which 3.1 percent was recycled. Another 5.35-million tons of plastic was combusted for energy recovery, and 26-million tons were landfilled. Considering recycling, repurposing, and combustion for energy recovery 75 percent of all plastic generated in the United States was landfilled for lack of any market. 48 Recycling rates fell slightly from 2014 to 2015.
- 2. Compared to other common AFs such as tire-derived fuel, mixed plastic is easy to process in conventional shredding and screening equipment. Mixed plastic is plentiful and can be viewed as an under-utilized resource. Mixed plastic, when properly source-controlled and processed, is a desirable fuel source for cement kilns. The combination of very long resident times and high temperatures in the cement kiln makes cement processing an ideal combustion environment. The ubiquity of plastic is such that it is relatively easy to arrive at a fuel mixture that is homogeneous and chemically compatible with the cement manufacturing process. The 12,000-17,000 Btu/lb heat content of mixed plastic fuel is higher than nearly all traditional solid fuels. Ash content is typically less than 3%, and sulfur and nitrogen are very low. Mineral content of the ash component is negligible and primarily made up of silica, aluminum, calcium and sodium. Alkali concentrations are lower than those for traditional solid fuel and at concentrations that will not adversely affect the cement manufacturing process.

⁴⁶ USEPA, Advancing Sustainable Materials Management: Facts and Figures Report, "Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States", July, 2018

⁴⁷ USEPA, July, 2018, ibid.

⁴⁸ USEPA, July, 2018, ibid.

TABLE 1: Fuel Specification and Comparison

Chemical Name	CAS Number	Units	Mixed Plastics incl. film Range/Typical	Solid Traditional Fuel Range (ppm)	Liquid Traditional Fuel Range (ppm)	Solid Trad. Fuel Spec (ppm)	Liquid Trad. Fuel Spec (ppm)	Comparison of Mixed Plastics incl. film to Solid and Liquid Fuel
Metal Elements, ppm - dry basis	ım - dry basis							
Mercury (Hg)	7439-97-6	mg/kg	0.043-0.303	ND-13.8		13.8		Lower than solid fuel
Cadmium (Cd)	7440-43-9	mg/kg	0.130-3.51	ND-19				Lower than solid fuel
Lead (Pb)	7440-92-1	mg/kg	1.19-71.4	ND-300				Lower than solid fuel
Selenium (Se)	7782-49-2	mg/kg	0.12-1.01	ND-74.3				Lower than solid fuel
Arsenic (As)	7440-38-2	mg/kg	0.130-1.04	ND-298		298		Lower than solid fuel
Antimony (Sb)	7440-36-0	mg/kg	0.370-1.81	ND-26				Lower than solid fuel
Beryllium (Be)	7440-41-7	mg/kg	0.142-0.178	ND-206				Lower than solid fuel
Chromium (Cr)	7440-47-3	mg/kg	3.83-27.4	ND-340				Lower than solid fuel
Cobalt (Co)	7440-48-4	mg/kg	0.700-1.76	ND-213				Lower than solid fuel
Manganese (Mn)	7439-96-5	mg/kg	2.84-68.1	ND-15,800				Lower than solid fuel
Nickel (Ni)	7440-02-0	mg/kg	2.16-18.9	ND-730				Lower than solid fuel

TABLE 1: Fuel Specification and Comparison

Liquid Trad. Comparison of Mixed Fuel Spec Plastics incl. film to Solid (ppm) and Liquid Fuel		Lower than solid fuel	Lower than solid fuel	Lower than solid & liquid fuel	187,500 Lower than solid & liquid fuel	
Solid Trad. L Fuel Spec F (ppm) (67,500	123,750 1	
Liquid Traditional Fuel Range (ppm)				ND-150,000	ND-150,000	
Solid Traditional Fuel Range (ppm)		ND-9080	ND-300	ND-54,000	000'66-QN	
Mixed Plastics incl. film Range/Typical		320-1670	36.0-43.0	2,300-12,900	100-400	
Inits		mg/kg	mg/kg	mg/kg	mg/kg	
3	. <u>Ş</u>	E	=	<u> </u>		
CAS Number Units	Non-metal Elements, ppm - dry basis	7782-50-5 п	7782-41-4 n	7727-37-9 n	7704-34-9	

18

Mixed Plastics - NHSM Self-Certification Documentation

TABLE 1: Fuel Specification and Comparison

Chemical Name	CAS Number	Units	Mixed Plastics incl. film Range/Typical	Solid Traditional Fuel Range (ppm)	Liquid Traditional Fuel Range (ppm)	Solid Trad. Fuel Spec (ppm)	Liquid Trad. Fuel Spec (ppm)	Comparison of Mixed Plastics incl. film to Solid and Liquid Fuel
Volatile Organic Compounds (VOC), ppm - dry basis	ompounds (VOC)), ppm - dr	y basis					
Benzene	71-43-2	mg/kg	ND	ND-38.6	ND-75	38.6	75	Not detected in target fuel
Ethylbenzene	100-41-4	mg/kg	∇	0.7-5.4	22-1,270			Lower than solid & liquid fuel
Styrene	100-42-5	mg/kg	ND-0.820	1.0-26	ND-320			Lower than solid & liquid fuel
Toluene	108-88-3	mg/kg	ND-0.170	8.6-56	ND-380			Lower than solid & liquid fuel
Cumene	98-82-8	mg/kg	ND		6,000-8,600			Not detected in target fuel
Formaldehyde	20-00-0	mg/kg	ND	1.6-2.7				Not detected in target fuel
Hexane	110-54-3	mg/kg	ND		50-10,000	T		Not detected in target fuel
Phenol	108-95-2	mg/kg	ND		ND-7,700	T		Not detected in target fuel
Xylenes	1330-20-7	mg/kg	ND-0.200	4.0-28	ND-3,100			Lower than solid & liquid fuel
Naphthalene	91-20-3	mg/kg	ND-1.6		ND-7,330			Lower than liquid fuel
Biphenyl	92-52-4	mg/kg	ND		1,000-1,200			Not detected in target fuel
Polycyclic hydrocarbons		mg/kg	65.1-67.6	14-2090	3,900-54,700			Lower than solid & liquid fuel

I. Introduction:

- A. This document shows that the furniture fiber, to be utilized as an alternative fuel by GCC ("Furniture Fiber Fuel"), meets the definition of Non-Hazardous Secondary Material (NHSM) fuel as described at 40 CFR 241. Furniture Fiber Fuel maybe referred to in other literature as furniture and mattress fiber, mattress fiber, fabric and fiber, or other terms. The following sections describe Furniture Fiber Fuel and how the material meets NHSM regulations as a non-waste fuel. The Process Description section in the application contains a description of the cement manufacturing process, documents how the AF is used to replace fossil fuels, and explains the benefits of using AF from an environmental standpoint.
- B. The initial furniture fiber materials will be received at a GCC-run processing facility. It will primarily consist of stuffed furniture and mattresses, rugs and carpets, with a variety of different wood furniture containing low concentrations of metal and glass. Any material mainly consisting of metal and/or glass is discarded as part of the fuel processing. Furniture fiber constitutes 60-80% of materials remaining after upholstered furniture, wood furniture, pressed wood furniture and components, mattresses and similar household furniture, and carpets have been processed and removed of metal, glass and non-combustible contents.¹
 - 1. Furniture fiber is derived from the processing of upholstered furniture, wood furniture, pressed wood furniture, mattresses and similar household furniture into beneficially-reusable raw materials. Furniture fiber constitutes the greater portion of upholstered furniture, wood furniture, pressed wood furniture, mattresses and similar household furniture after metal, glass, and any non-combustible content are removed. Furniture fiber is composed of wood, pressed wood, natural fiber, synthetic fiber, leather, plastics, rubber, foam, paper, and may contain some residual metal pieces, glass, silica (marble or granite components) sand, and dirt. Natural and synthetic fibers include wool, cotton, nylon, polypropylene, polyester, acrylic and rayon (which is derived from wood). Approximately 50-80 percent of unprocessed dry shredded furniture is combustible, including cellulosic fiber and wood, synthetic fiber, fabric, plastics, rubber, foam, paper.² Incombustible components include metals, glass, dirt, and ash.
 - 2. Without processing, shredded furniture would have limited value as fuel due to its high content of metal, glass, porcelain, marble, granite, or electrical components. Unprocessed shredded furniture has an estimated heating value of roughly 4,300- 8,000 BTU/lb and is a highly heterogeneous mix of materials made up of about 60-65% fiber and wood, 30-35% residual metals, <1% foam, and trace amounts of glass, wood, paper, cardboard, and plastics.³ Prior to use as a fuel, shredded furniture requires significant separation and processing to isolate the combustible materials with significant heat value, low ash content

¹ Arthur R. Boone, "Couches and Mattresses: The Next Recoverable," *Resource Recycling*, October 1994, 47, https://p2infohouse.org/ref/06/05923.pdf.

² Ibid.

³ Ibid.

- and low contaminant concentrations. Particles, pieces, chips, and fluff tend to agglomerate into loose clumps so the material does not tend to flow freely.
- 3. Furniture Fiber Fuel is a low-density solid material with particles in a range of sizes. It is primarily a combination of wood particles and chips, 2-dimensional fabric pieces of varying size, fluffy, light, fibrous material, paper, cardboard, and some plastic. The maximum particle size is determined strictly by the amount of processing required to produce an efficient fuel product. Although a typical maximum particle size is 4-6" square or less, fuel product requirements are dictated by the type of fuel feed equipment and fuel feed point in the kiln system. The material components of Furniture Fiber Fuel are not generally friable, so there is a minimal quantity of very fine material

II. NHSM Determination Criteria

- A. Furniture Fiber Fuel is sourced, processed, cleaned, transported and stored in a way that identifies it as a valuable commodity (40 CFR §241.3)(c)(1)(i).
 - SOURCE CONTROL Generators of source materials used to make Furniture Fiber Fuel fall
 into three general categories. One, commercial furniture haulers or installers who collect
 used furniture, mattresses, rugs, carpets and similar fiber-containing products from
 residential or commercial delivery, installation, removal, and pickup ("Commercial
 Generators"). Two, through municipal collections systems where furniture, mattresses, rugs,
 carpets, and similar fiber-containing post-consumer durable goods are collected as a single
 isolated stream that is not comingled with solid waste, trash, yard waste, or other types of
 material ("Municipal Generators"). Three, from facilities that are engaged in the
 manufacture of furniture, mattresses or similar consumer goods; and who create and
 capture coproducts or byproducts from the manufacturing process ("Manufacturing
 Generators").
 - a. Prior to selection as a supplier of source material, generators must demonstrate the technical, operational, and administrative capacity to adequately guarantee product control. All generators are expected to have established acceptance and rejection standards, adequate management structure and staffing for effective operation, mechanical and administrative means to assure product control, and facilities that conform to accepted norms of operation and comply with legal and environmental standards. After selection, generators are subject to regular audit to assure continued adherence to the established performance standards.
 - b. In cases where source material is obtained from Commercial Generators, Generator performance is managed under a Materials Management Agreement ("Agreement"). The Agreement terms stipulate non-waste status of source material and require the Generator to certify non-waste source material status. The Agreement terms also stipulate product control from the point of generation, control of inventories, rejection of hazardous waste or solid waste, isolation from contaminants, identification and

handling of non-conforming source material, and consistency of product makeup. Each Agreement includes a specification of each source material received, including sampling regimen and frequency.

- c. In the case of Municipal Generators, post-consumer furniture fiber source material is derived from mattresses, upholstered furniture, wood furniture, plastic furniture, shelving, and office furniture which is received as a one stream. Furniture fiber source material is not comingled solid waste, trash, yard waste, or other material. As discussed in this document, the recovery of multiple beneficial products is a well-established practice across the United States, but commercial recovery of materials from scrap furniture is limited. A Post-consumer material recycling requires that materials processed for reentry into the recycled raw material stream to be used in consumer products manufacturing must meet certain quality standards. In order to be considered as suppliers of furniture fiber source material for GCC, Municipal Generators must demonstrate the same standards of material acceptance and rejection as commercial sources. When Municipal Generators are privately operated by contractors, contractors are subject to a Materials Management Agreement ("Agreement"). The Agreement terms stipulate non-waste status of source material and require the Generator to certify non-waste source material status. The Agreement terms also stipulate product control from the point of generation, control of inventories, rejection of hazardous waste or solid waste, isolation from contaminants, identification and handling of non-conforming source material, and consistency of product makeup. Each Agreement includes a specification of each source material received, including sampling regimen and frequency. In cases where Municipal Generators are operated by government entities that are prohibited from entering into a Materials Management Agreement, an AFs Guidance Document ("Fuels Guidance") in the same form as a Materials Management Agreement is adopted. Each Fuels Guidance includes a specification of each source material received, including sampling regimen and frequency.
- d. In cases where the source material is obtained from Manufacturing Generators, Generator performance is managed under a Materials Management Agreement ("Agreement"). The Agreement terms stipulate non-waste status of source material and require the Generator to certify non-waste source material status. The Agreement terms also stipulate product control from the point of generation, control of inventories, rejection of hazardous waste or solid waste, isolation from contaminants, identification and handling of non-conforming source material, and consistency of product makeup. Each Agreement includes a specification of each source material received, including sampling regimen and frequency. The source material is collected at the point of generation and transferred to storage at the source facility. The source material may be mixed or comingled with similar source materials originating in the same facility. Source

⁴ Arthur R. Boone, "Couches and Mattresses: The Next Recoverable," *Resource Recycling*, October 1994, 47, https://p2infohouse.org/ref/06/05923.pdf.

materials may not be mixed or commingled with trash, refuse, contaminants, or any materials that do not fit the description of constituents of Furniture Fiber Fuel. For example, in the manufactured upholstered furniture, upholstery fabric trimmings, stuffing, batting and wood scrap may be mixed in the same inventory at the source facility but may not be mixed with plastic, paper, oils, trash, or other non-furniture fiber contaminants. Small incidental quantities of materials, such as plastic labeling are considered normal and acceptable. Source materials at the generator facility will be stored in areas designated for the specific purpose, and those areas are maintained to prevent cross contamination with materials that are not components of the source material for Furniture Fiber Fuel.

- e. Collection is limited to a narrow class of material generally including post-consumer household or commercial furniture and mattresses, pre-consumer manufacturing byproducts or co-products and broadly excluding many types of unsuitable material. In addition to unsuitable material, material that is specifically prohibited includes:
 - Radioactive material
 - · Explosive material or munitions
 - Biohazards, chemicals, and hazardous waste
 - Flammable liquids
 - Ballasts, transformers or capacitors without non-PCB label
 - Pressurized gas cylinders or sealed containers
 - Tanks or drums without empty-tank certification
 - Asbestos
 - Mercury
- 2. RECEIPT OF MATERIALS The source material is received at the collection facility into covered, designated areas with concrete floors where it is not subject to intermingling with other material or waste, and not subject to environmental contamination or degradation. Intake of the material is managed and directly overseen by trained personnel. All incoming material is examined for certain materials that will be rejected including, but not limited to:
 - Appliances and white goods
 - Televisions and electronic waste
 - Electrical or mechanical devices or components
 - · Building materials
 - General refuse
- SELECTIVE SORTING Following receipt, the material is manually sorted by type to eliminate PVC furniture or furniture containing electronics. Furniture constructed primarily of glass and/or metal is separated for recycling by material type. Components such as marble or

granite tabletops that are not suitable for recycling and difficult to handle during downstream processing are also removed and disposed of at this stage.

4. INITIAL PROCESSING – The materials are transferred from the sorting and picking area to the primary shredder. The bulk material varies widely in size, shape, bulk density and construction. The first step of shredding is designed to reduce materials to a consistent and manageable particle size, homogenize the bulk material, and free constituents that are encapsulated in the material so that unwanted fractions can be removed later in the process. Initial shredding reduces the bulk material to a sufficiently small particle size to allow efficient mechanical separation.

Materials exiting the shredder are conveyed through a magnetic separator to extract ferrous metals. Ferrous metal removed is stored for recycling through conventional metal recycling processes. Friable material such as glass is pulverized by the force and mechanical action of the shredding operation and may be readily removed by a small-mesh trommel screen or reciprocating screen, which further homogenizes the material. The remaining bulk shredded material with metal and glass removed is largely made up of wood particles and chips, 2-dimensional fabric pieces of varying size, fluffy, light, fibrous material, foam, paper and cardboard, with some plastic.

The shredded and screened material is transferred to a final shredding stage to achieve a higher bulk density, consistent particle size, and homogeneous mixture. The higher bulk density and smaller particle size are required in order to fully homogenize the material, minimize the tendency to agglomerate into clumps, improve handling in fuel feed equipment, and deliver sufficient heat value per unit of volume. The homogenization ensures consistent quality when the material is used as a fuel. Material exiting the secondary shredding stage is conveyed through a second magnetic separator to remove any remaining ferrous metal. The result is a material that is essentially free of metal, glass and contaminants.

5. RECEIPT AND INTAKE OF SOURCE MATERIAL – Source material is received by truck or by rail from the generator. Material acceptance is governed in accordance with standards set forth in the Materials Management Agreement or Fuels Guidance and their attached specifications. Materials receipt is managed by trained personnel. Incoming materials are first examined to verify that they meet the description set forth in the specification. Any incoming material that does not meet the specification criteria is considered non-conforming material. Loads with identified non-conforming material are rejected prior to acceptance and returned to the generator.

Methods of tracking incoming source material, including documentation procedures, are defined in the QAQC plan for the processor and combustion facility.

Non-conforming material that is identified after incoming furniture fiber source material has been accepted by the GCC processor or the GCC combustion facility is evaluated in accordance with South Dakota regulations under the definition of Solid Waste in SDCL: 34A-6-1.3(17) and treated in a manner appropriate to the material type. In general, non-conforming material is isolated from furniture fiber source material and isolated from other consumable materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility, and is held only as long as necessary to arrange for proper disposition as outlined below.

Non-conforming, non-waste material is, when possible, used in another part of the process at the combustion facility if the non-waste material meets the definition of, and conforms to the specifications of, a NHSM fuel or ingredient that is already qualified for use at the combustion facility AND is already used at the combustion facility. In this case, "non-conforming material" refers only to material that does not conform to the specifications of furniture fiber source material or Furniture Fiber Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that non-conforming material to the correct inventory, and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility, it will be transferred or disposed of as appropriate.

Non-conforming, non-hazardous material that is identified as solid waste is transferred to a landfill that accepts the type of waste. Inventory records will reflect the transfer of that non-conforming material. Non-conforming material that is identified as non-hazardous liquid waste, non-hazardous semisolid waste or non-hazardous contained gaseous waste is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

- 6. Non-conforming material that is identified as hazardous waste is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the type of waste identified, and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.
- 7. SUMMARY OF THE "PROCESSING CRITERIA": Furniture Fiber Fuel meets the requirement of sufficient processing as supported by process descriptions used in the Categorical Exclusion for C&D Wood from C&D debris. The treatment of exclusion and sorting by the collection facility and generator of furniture fiber is similar to the requirements for positive and negative sorting, and training, in the Categorical Exclusion of C&D wood processed from

C&D debris⁵, and in the non-waste determination for SpecFUEL.⁶ The selection, exclusion, sorting, and processing steps to produce Furniture Fiber Fuel are nearly identical to the steps described in the non-waste determination of Roaring Spring Biofuel "fuel cubes" and highly similar to the processing steps and general makeup of the material described in the non-waste determination of Greenwood Fuels LLC "fuel pellets." ⁸

- B. The following section and corresponding table provides documentation that the chemical and physical identity of Furniture Fiber Fuel is comparable to commercial fuels (40 CFR §241.3)(c)(1)(ii), that material provides heating value for GCC's cement kilns (40 CFR §241.3(d)(ii), and that contaminants in Furniture Fiber Fuel are comparable to those in traditional fuel (40 CFR §241.3(d)(iii).
 - MEANINGFUL HEAT VALUE: The processed Furniture Fiber Fuel has a significant fuel value.
 Calorimetry of Furniture Fiber Fuel samples show that the material has gross heating values in the range of 7,000-10,000 Btu/lb on an as-received basis; greater than 5,000 Btu/lb as fired threshold (76 FR 15541, March 21, 2011). The Furniture Fiber Fuel makes a useful contribution to the cement clinker manufacturing process which inherently requires substantial heat input.
 - 2. CONTAMINANT COMPARISON: Table 1 compares contaminants of Furniture Fiber Fuel with those of the traditional fuel values for fuel that GCC's kilns are designed to utilize. GCC's kilns are all designed to utilize solid fuels, and each facility can additionally utilize liquid and/or gaseous fuels. Table 1 documents the traditional solid fuel range of values. No comparison is made to liquid and gaseous traditional fuel ranges since constituents of Furniture Fiber Fuel are all below ranges reported for solid fuels.

Analytical results from Furniture Fiber Fuel show that it is a beneficial replacement for traditional fuels in GCC's cement kilns. Contaminant ranges are typically lower than contaminant ranges for solid fuels by an order of magnitude or more. In the metals group, most values are lower than the comparable values for traditional solid fuels by one ortwo orders of magnitude. Chlorine, fluorine and sulfur are all lower than comparable traditional fuel values by an order of magnitude. Nitrogen content is approximately half of that for traditional solid fuel. Comparable volatile organic compounds (VOCs) are generally below

⁵ Non-Waste Determinations for Specific Non-Hazardous Secondary Materials When Used as a Fuel., 40 C.F.R. § 241.4 (2018).

⁶ Letter by Barnes Johnson, "Non-waste determination for SpecFUEL," n.d., accessed December 20, 2018, https://archive.epa.gov/epawaste/nonhaz/define/web/pdf/specfuel.pdf.

⁷ United States Environmental Protection Agency (EPA), 2013-02-06 "non-waste determination for fuel cubes" letter to Roaring Spring Biofuel.

⁸ United States Environmental Protection Agency (EPA), 2011-11-14 "non-waste determination for fuel pellets" letter to James S. Rickrun Environmental Consulting.

the low end of the VOC range in traditional solid fuel, some by an order of magnitude or greater.

Three compounds in the volatile organic compound group were detected in Furniture Fiber Fuel that are not reported in databases for traditional fuel, at very low concentrations.

- a. Trichlorofluoromethane was detected at 12.0 mg/kg in one sample. Prior to 1996, trichlorofluoromethane was widely used as a low-pressure refrigerant, as an industrial solvent, as a propellant in aerosol cans, and in the production of Styrofoam.⁹ It is commonly referred to as Refrigerant-11, Freon-11 or Fluorocarbon- 11.¹⁰ There has been recent indication that trichlorfluoromethane is still being manufactured and used as a blowing agent in parts of central Asia.^{11,12}
- b. Dibromomethane is detected at concentrations up to 1.10 mg/kg. Dibromomethane is commercially used as a solvent or as a gauge fluid,¹³ and is naturally produced by marine algae.¹⁴ Dibromomethane may be harmful in quantities large enough to inhale or swallow,¹⁵ but is not expected to be a concern at the minute quantity detected.
- c. p-Isopropyltoluene, also referred to as p-Cymene, is detected at low concentrations (2.40 mg/kg). p-Isopropyltoluene is used as a flavoring agent in foods,¹⁶ and is found naturally-occurring in the essential oils of more than 100 plants and 200 foods.¹⁷ It is considered to be Generally Recognized as Safe (GRAS) by the U.S. Food and Drug Administration.¹⁸
- C. The storage and materials management of Furniture Fiber Fuel at all phases from generation to the point of combustion meet the requirements of (40 CFR §241.3)(c)(1)(iii) and (40 CFR §241.3(d)(1)(i)(A)).

⁹ National Center for Biotechnology Information, "Trichloromonofluoromethane," *PubChem Compound Database*, https://pubchem.ncbi.nlm.nih.gov/compound/6389#section=MeSH-Entry-Terms.

¹⁰ Ibid.

¹¹ Stephen A. Montzka, "An unexpected and persistent increase in global emissions of ozone-depleting CFC-11," nature 557 (May 16, 2018): 413, accessed December 20, 2018, https://doi.org/10.1038/s41586-018-0106-2.

¹² David E. Oram, "A growing threat to the ozone layer from short-lived anthropogenic chlorocarbons," *Atmospheric Chemistry and Physics*, 11929th ser., June 2017, 17, https://doi.org/10.5194/acp-17-11929-2017.

¹³ National Center for Biotechnology Information, "Dibromomethane," *PubChem Compound Database*, https://pubchem.ncbi.nlm.nih.gov/compound/dibromomethane#section=Top.+

¹⁵ International Chemical Safety Card 0354 (ICSC:0354)

¹⁶ National Institutes of Health, Chemistry Information Database #7463 (CID:7463) https://pubchem.ncbi.nlm.nih.gov/compound/p-cymene

¹⁷ Marchese, Anna et al. "Update on Monoterpenes as Antimicrobial Agents: A Particular Focus on p-Cymene" Materials **2017**, *10*, 947; doi:10.3390/ma10080947

¹⁸ Synthetic Flavoring Substances and Adjuvants., 21 C.F.R. § 172.515 (2018).

- Furniture Fiber Fuel is not accumulated in any significant quantity or for any significant
 period of time at the generator facility. Typical storage time is less than one month from the
 time of generation to the time the Furniture Fiber Fuel is distributed. Distribution occurs by
 truck, and the material is weighed with weights recorded on a uniform bill of lading. Records
 of Furniture Fiber Fuel distribution are recorded and retained. Furniture fiber is either sold
 as fuel or sold as a binder for commercial compost manufacturing. Unsold furniture fiber is
 often sent to a landfill.
- 2. Furniture Fiber Fuel is a solid material in loose bulk form with handling characteristics similar to low-density traditional solid fuels. Storage and management of Furniture Fiber Fuel at GCC facilities is comparable to storage and management of the traditional solid fuels at the same GCC facilities. Furniture Fiber Fuel is delivered by trucks with dump trailers or walking floor trailers. Incoming material is weighed, and weights are compared to weights on the bill of lading. Material is accounted for in accordance with inventory management practices established for other bulk solid fuel and raw material at the combustion facility. Inventory is valued on a first-in-first-out basis. Inventories commonly contain a supply sufficient for 30-90 days of operation, but in no case longer than one year. Inventory time frame is comparable to the time frame in EPA's speculative accumulation concept in RCRA and is consistent with GCC's solid traditional fuels inventory management time frames.
- D. In accordance with 40 CFR §241.3(d)(1)(B) and (C) furniture fiber is handled in a manner similar to that for traditional solid fuel to prevent releases to air, water or land.
 - 1. At the generator facility, furniture fiber production, transfer, storage, and loading are conducted in a way that minimizes air-borne and water-borne dispersion. Trucks transporting furniture fiber at any point from the point of generation to the point of combustion are covered to prevent airborne releases. Delivery of material, processing of material into shredder furniture, removal of contaminants, and final shredding are all enclosed to prevent airborne releases. Rainwater releases are controlled in accordance with a storm water management plan. The generator site carries an NPDES permit. Fugitive air emissions are governed by Title V air permit requirements, with controls similar to traditional solid fuels.
 - 2. Furniture fiber source material is transported from the generator to the processor, and Furniture Fiber Fuel is transferred from the processor to the end user, in covered or uncovered trailers appropriate to the type of material. Source material in whole form, such as mattresses, office furniture, upholstered furniture, etc. may be transported on open flatbed trailers or in open trucks. Source material in shredded form, or Furniture Fiber Fuel, is transferred in enclosed trucks or roll-offs, storage containers, or where appropriate by conveyor. Because of their tendency to absorb and retain rainwater, these whole materials may be stored outdoors only for very limited time as daily working inventory or during transfer. Inventories are not tracked by weight until after processing. After initial processing for size reduction, these same materials may not be stored outdoors.

3. Constituent releases to water or land from furniture fiber source material and Furniture Fiber Fuel are controlled by containment, cover, and traditional storm water management plans and practices. Releases to air are unlikely except in cases of fire. Outdoor storage of furniture fiber source material and Furniture Fiber Fuel must be covered to prevent water infiltration. Any runoff caused by rainwater releases is controlled in accordance with a storm water management plan. The generator site, processor site, and combustion location are designed to limit water infiltration of material, and any water generated on site is subject to the requirements of NPDES permit requirements or similar governing requirements.

Furniture fiber and Furniture Fiber Fuel can catch fire when exposed to ignition sources. When stored, furniture fiber source material and Furniture Fiber Fuel are stored in accordance with NFPA 230 guidelines¹⁹ to prevent releases to air.

- a. Piles separated from one another by approved fire apparatus access roads.
- b. Low barrier walls provided around piles to define pile perimeter and prevent creeping.
- c. Physical protection provided to prevent heat sources such as steam lines, air lines, electric motors, and mechanical drive equipment from becoming buried or heavily coated with material.
- d. A minimum of 15 feet maintained between piles and exposing structures, yard equipment or stock depending on the degree of the exposure.
- Appropriate number of fire extinguishers suitable for Class A fires shall be provided in accordance with NFPA 10, Standard for Portable Fire Extinguishers.
- f. Water supplies in the area shall be provided in accordance with NFPA 1 Uniform Fire Code.
- g. Pile temperature monitored using infrared scanners.
- 4. At the combustion facility, rainwater releases from the Furniture Fiber Fuel management area at the GCC facilities are controlled by an NPDES storm water permit. Fugitive air emissions are governed by the Title V air permit requirements, with controls similar to traditional solid fuels.
- Non-conforming material that is identified after incoming furniture fiber source material or Furniture Fiber Fuel has been accepted by the GCC processor or GCC combustion facility is evaluated in accordance with South Dakota regulations under the definition of Solid Waste in SDCL: 34A-6-1.3(17) and treated in a manner appropriate to the material type. In general,

¹⁹ https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/defail?code=230, accessed April, 2019.

non-conforming material is isolated from furniture fiber source material and Furniture Fiber Fuel and is isolated from other consumable materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility, and is held only as long as necessary to arrange for proper disposition as outlined below.

Non-conforming, non-waste material is, when possible, used in another part of the process at the combustion facility if the non-waste material meets the definition of, and conforms to the specifications of, a non-hazardous secondary material fuel or ingredient that is already qualified for use at the combustian facility AND is already used at the combustion facility. In this case, "non-conforming material" refers only to material that does not conform to the specifications of Furniture Fiber Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that non-conforming material to the correct inventory, and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility, it will be transferred or disposed of as appropriate.

Non-conforming, non-hazardous material that is identified as solid waste is delivered to a landfill that accepts the type of waste. Non-conforming, nan-hazardous material that is identified as non-hazardous liquid waste, non-hazardous semisolid waste or non-hazardous contained gaseous waste is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

Non-conforming hazardous waste material that is identified is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the type of waste identified, and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

SDCL: 34A-6-1.3(17) "Solid waste," any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include mining waste in connection with a mine permitted under Title 45, hazardous waste as defined under chapter 34A-11, solid or dissolved materials in domestic sewage or dissolved materials in irrigation retum flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended to January 1, 2011, or source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended to January 1, 2011;

E. Other relevant factors

- 1. Furniture and mattresses are not widely recycled. They are big, bulky, made up of a wide variety of materials, and do not tend to produce a high enough volume of common recyclables, such as steel, to warrant economic consideration.²⁰ Of all materials used in the manufacture of furniture fiber fuel, mattress recycling is the only element that has gained any significant attention. At the same time, furniture and mattresses are difficult to landfill. They do not compact well, create flammable air pockets, tend to float to the surface, contain non-biodegradable foams and fibers, and the spring steel can damage compacting equipment.^{21,22} Additionally, mattress recycling is not an economically viable business venture and principally depends on materials recovery and reuse, which is tedious and labor intensive.²³ Steel is the only major component of mattresses that is widely recycled.
- 2. The fiber remaining after removal of metal from furniture that has already been sorted to exclude non-combustible material, such as glass, is a viable and plentiful material to be considered as fuel in cement production. Compared to other common AFs such as tire-derived fuel, furniture is easy to process in conventional shredding and screening equipment. Unlike other avenues for recycling of textiles and wood, isolation of the many components of furniture structure is not required provided the final mixture is homogeneous and chemically compatible with the cement manufacturing process. Mineral content of the ash component is primarily made up of silica and calcium, both of which are beneficial to cement manufacture but the contribution is negligible because of the low ash content. Alkalis concentrations are lower than those for traditional solid fuel and at concentrations that will not adversely affect the cement manufacturing process.

²⁰ Sofia Bennet, "How to Recycle Furniture," Recycle Nation, last modified June 9, 2014, accessed December 20, 2018, https://recyclenation.com/2014/06/recycle-furniture/.

²¹ Anna Kerr, 2015 Solid Waste Policy Report, report no. lrw-sw-lsy15, 41, January 2016, accessed December 20, 2018, https://www.pca.state.mn.us/sites/default/files/lrw-sw-1sy15.pdf#page=46.

²² Cascade Alliance, *The State of the Mattress Recycling Industry*, 1, July 2017, accessed December 20, 2018, https://cascadealliance.us/wp-content/uploads/2017-Mattress-Recycling-White-Paper.pdf.

²³ Arlene Karidis, "The Mattress Recycling Council Continues to Boost its Reach," Waste360, last modified February 16, 2017, accessed December 20, 2018, https://www.waste360.com/recycling/mattress-recycling-council-continues-boost-its-reach.

TABLE 1: Fuel Specification and Comparison

Chemical Name	CAS Number	Units	Furniture Fiber Fuel Range/Typical	Solid Traditional Fuel Range (ppm)	Solid Trad. Fuel Spec (ppm)	Comparison of Furniture Fiber to Solid Fuel
Metal Elements, ppm - dr	y basis					
Mercury (Hg)	7439-97-6	mg/kg	.03924	ND-13.8	13.8	Lower than solid fuel
Cadmium (Cd)	7440-43-9	mg/kg	1.1-5	ND-19		Lower than solid fuel
Lead (Pb)	7440-92-1	mg/kg	<5-33.9	ND-300		Lower than solid fuel
Selenium (Se)	7782-49-2	mg/kg	0.10-3.0	ND-74.3		Lower than solid fuel
Arsenic (As)	7440-38-2	mg/kg	0.24	ND-298	298	Lower than solid fuel
Antimony (Sb)	7440-36-0	mg/kg	10.0-20.6	ND-26		Lower than solid fuel
Beryllium (Be)	7440-41-7	mg/kg	ND-0.117	ND-206		Lower than solid fuel
Chromium (Cr)	7440-47-3	mg/kg	5.21-25.0	ND-340		Lower than solid fuel
Cobalt (Co)	7440-48-4	mg/kg	1.1-20	ND-213		Lower than solid fuel
Manganese (Mn)	7439-96-5	mg/kg	5.0-21.6	ND-15,800		Lower than solid fuel
Nickel (Ni)	7440-02-0	mg/kg	2.5-5.0	ND-730		Lower than solid fuel
Non-metal Elements, ppm	ı - dry basis					
Chlorine (Cl)	7782-50-5	mg/kg	550	ND-9080		Lower than solid fuel
Fluorine (F)	7782-41-4	mg/kg	24	ND-300		Lower than solid fuel
Nitrogen	7727-37-9	mg/kg	29,200	ND-54,000	67,500	Lower than solid fuel
Sulfur (S)	7704-34-9	mg/kg	3300-5,500	ND-99,000	123,750	Lower than solid fuel
Volatile Organic Compour	nds (VOC), ppm	- dry basis				
Benzene	71-43-2	mg/kg	ND	ND-38.6	38.6	Lower than solid fuel
Ethylbenzene	100-41-4	mg/kg	ND-0.57	0.7-5.4		Lower than solid fuel
Styrene	100-42-5	mg/kg	ND	1.0-26		Lower than solid fuel
Toluene	108-88-3	mg/kg	ND-0.8	8.6-56		Lower than solid fuel
Cumene	98-82-8	mg/kg	ND			Lower than solid fuel
Formaldehyde	50-00-0	mg/kg	ND	1.6-2.7		Lower than solid fuel
Hexane	110-54-3	mg/kg	ND			Lower than solid fuel
Phenol	108-95-2	mg/kg	ND			Lower than solid fuel
Xylenes	1330-20-7	mg/kg	ND-2.31	4.0-28		Lower than solid fuel
Naphthalene	91-20-3	mg/kg	ND			Lower than solid fuel
Biphenyl	92-52-4	mg/kg	ND			Lower than solid fuel
Polycyclic hydrocarbons		mg/kg	<110	14-2090		Lower than solid fuel

I. Introduction:

A. This document shows that the auto shredder residue to be utilized as an alternative fuel ("ASR Fuel") by GCC meets the definition of Non-Hazardous Secondary Material (NHSM) fuel as described at 40 CFR 241. Auto shredder residue may be referred to in other literature as ASR, auto fluff, or auto shredder fluff, or other terms. The following sections describe the ASR Fuel and how the material meets the NHSM regulations as a non-solid waste fuel. The Process Description section in the NHSM Management Manual contains a description of the cement manufacturing process, documents how the AF is used to replace fossil fuels, and explains the benefits of using AF from an environmental standpoint.

Historically, auto shredder residue's high content of non-ferrous metals and contaminants rendered it unusable as a commodity. Recently however, technological advancement and investment in advanced processing systems have shown to have economic benefit by separation of auto shredder residue into many valuable co-products, including non-ferrous metals.¹ Much of the motivation to develop technology that improves the rate of recycling has been driven by a directive from the European Union's Parliament that directs Member States to ensure 95% of reuse and recovery and 85% of reuse and recycling in end-of-life vehicles by 1 January 2015.² Removal of contaminants at the first stages of the auto recycling process andfollowed by efficient separation of components in auto shredder residue and removal of metal contaminants in the small fraction has led to the recognition that auto shredder residue can be a source of recyclable plastics or as a fuel in cement kilns.^{3,4}

- B. Auto shredder residue constitutes the 20 to 25 percent of materials remaining after vehicles, appliances and similar durable goods have been shredded and removed of reusable parts and metals.
 - Auto shredder residue is derived from the processing of whole automobiles, appliances and similar durable goods into beneficially-reusable raw materials. Auto shredder residue is composed of plastics, rubber, foam, paper, fabric, and may contain some residual metal pieces, glass, sand, and dirt^{5,6,7} (EPA, 2008; USCAR, 2008; Nourreddine, 2007).
 Approximately 20 to 50 percent of unprocessed dry auto shredder residue is combustible,

¹ Krehla, Stephen "The Next Generation" Recycling Today, January 7, 2013.

² Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles, Article 7.

³ Havlik, Tomas "Recycling of automotive shredder residue by granulometric separation" *MM Science Journal*" June, 2017, pp. 1810-1813.

Cooper, Savannah "Recycling Auto Shredder Residue" Waste Advantage, September 23, 2014.

⁵ United States Environmental Protection Agency (EPA), 2011, Materials Characterization Paper in support of the Final Rulemaking: Identification of Nonhazardous Secondary Materials that are Solid Waste, Auto Shredder Residue.

⁶ Nourreddine, Menad. 2007. "Recycling of Auto Shredder Residue." Journal of Hazardous Materials 139(3): 481-490

United States Council for Automotive Research, 2008. DID YOU KNOW THAT CARS ARE THE MOST RECYCLED PRODUCT IN AMERICA? USCAR's Vehicle Recycling Partnership Shares Green Message at 2008 NAIAS. Press Release. 1/14/2008

including plastics, fabric, and rubber. Incombustible components include metals, glass, dirt, and ash.8

- 2. Without processing, auto shredder residue would have limited value as fuel, due to its high ash content, the presence of contaminants (including heavy metals, chlorine, and PCBs), and the high content of incombustibles. Unprocessed auto shredder residue has an estimated heating value of roughly 5,000 Btu/lb and is made up of about 30% polymers (by weight), 10% residual metals, 5% foam, and the remainder is a mix of glass, wood, paper, sand, dirt, rocks, and automotive fluids.⁹ Prior to use as a fuel, auto shredder residue requires significant separation and processing to isolate the combustible materials with low ash content and low contaminant concentrations.
- 3. ASR Fuel supplies beneficial fuel value by replacing fossil fuels in GCC's cement manufacturing facilities. After processing, auto shredder residue has a heat value comparable to traditional fuels and contains noncombustible components that are comparable to traditional fuels. ASR Fuel has no negative impact on the cement manufacturing process and is introduced into the cement manufacturing process in the manner of a bulk solid fuel.

II. NHSM Determination Criteria

- A. Quality assurance and quality control procedures are in place throughout the processes of generation, beneficiation, material management and final processing to assure that ASR Fuel is treated as a product versus solid waste in accordance with 40 CFR §241.3(c)(1)(i).
 - SOURCE CONTROL: Whole automobiles and similar materials are received by the processor from contracted commercial sources who are subject to rigid material acceptance standards to exclude:
 - Radioactive materials
 - Explosive materials and live munitions
 - Biohazards, chemicals, and hazardous waste
 - Ballasts, transformers or capacitors without non-PCB label
 - Pressurized gas cylinders or sealed containers
 - Tanks or drums without empty-tank certification
 - Yard wastes
 - Flammable liquids
 - Mercury
 - Asbestos

⁸ United States Environmental Protection Agency (EPA), 2011, Materials Characterization Paper in support of the Final Rulemaking: Identification of Nonhazardous Secondary Materials that are Solid Waste, Auto Shredder Residue.

⁹ Boughton, Robert. 2006. "Evaluation of shredder residue as cement manufacturing feedstock." California Department of Toxic Substances Control.

Loads containing any of these prohibited items are rejected. The processor conducts regular audits of commercial sources to assure continued compliance. The processor may also collect whole automobiles on its own from salvage yards using its own equipment and trained staff.

- RECEIPT OF MATERIALS: Materials are received by truck or by rail. Material receipts are
 managed by trained personnel. Incoming materials undergo visual screening for items
 prohibited by material acceptance standards and undergo radiation screening using
 stationary and hand-held radiation detectors. Radiation detectors are source-tested on a
 regular schedule.
- 3. REMOVAL OF CONTAMINANTS: Liquids such as washer fluid, brake fluid, antifreeze, gasoline, diesel fuel, and lubricating oil are evacuated mechanically from whole automobiles. Evacuated liquids are isolated for recycling using commercial liquid recovery equipment. Clean fuel recovered from automobiles may be reused directly. Refrigerants are evacuated in a designated facility. Lead-acid batteries are removed and sent to an outside recycling facility. Mercury-containing devices such as mercury switches are removed manually by trained personnel. The processor maintains a database that lists mercury-containing devices in automobiles by make and model.
- 4. INITIAL PROCESSING OF WHOLE AUTOS: Whole autos are conveyor-fed into shredding machines that reduce materials to a particle size that can facilitate efficient separation. A final screening for radioactive materials is made at the point of size reduction using cross-belt radiation detectors. Size reduction is followed by magnetic separation to remove ferrous metals from nonmetallic and nonferrous material. The non-metallic, non-ferrous portion is screened by size. Larger material undergoes additional size reduction by shredding. Size reduction and consistency in particle size assure efficient separation into components of non-ferrous material.
- 5. PROCESSING OF NON-FERROUS MATERIALS TO ISOLATE AUTO SHREDDER RESIDUE FUEL: Non-ferrous material remaining after magnetic separation undergoes further beneficiation into multiple reusable products using eddy-current induction separation and air induction separation processes. Mechanical feed systems deliver a uniform, thin, consistent material flow to maximize efficiency of eddy-current and sensor-based separation. Non-ferrous metals are removed and separated according to metal type. Non-metallic components are further separated using air induction separation to create two more products, ASR Fuel and ferritic dirt. Ferritic dirt is a fine dirt-like material with ferromagnetic properties. Removal of fine material in the range of < 1 mm has been shown to remove components with high content of metals.¹⁰

¹⁰ Havlik, Tomas "Recycling of automotive shredder residue by granulometric separation" *MM Science Journal*" June, 2017, pp. 1810-1813.

- 6. FINAL PROCESSING AT THE COMBUSTION FACILITY: If necessary to meet particle size requirements for feed equipment design, ASR fuel undergoes further processin. Processing consists of shredding and screening using conventional shredding equipment. Sieve analysis at the combustion facility is used to determine the final processing requirement.
- 7. SUMMARY OF THE "PROCESSING CRITERIA": ASR Fuel meets the requirement of sufficient processing as supported by process descriptions used in the non-waste determination for processed oil filter fluff 11 based on contaminant removal and sufficient processing. The treatment of ASR Fuel by the generator is also similar to requirements for positive and negative sorting, and training in the Categorical Exclusion for C&D wood processed from C&D debris.¹² The materials used to produce auto shredder residue are under rigid source control. Materials reception protocols include mechanical and visual examination to reinforce materials exclusion. Contaminants are removed by mechanical and manual means prior to processing. Auto shredder residue is prepared for fuel use by separation and processing to isolate the combustible materials with low ash content and low contaminant concentrations. Initial processing is done by the generator using a combination of mechanical sorting by size and magnetic separation. Subsequent processing may include density separation, eddy-current separation, air induction separation, and magnetic separation which is designed to further remove incombustible components of the auto shredder residue stream. Final preparation involves sizing and shredding. The result is a mixture of auto shredder residue that maximizes energy content while minimizing content of ash, chlorine and heavy metals. Processing of the auto shredder residue typically achieves a mixture that represents approximately 30 to 50 percent of the non-ferrous portion of unprocessed auto shredder residue, with an energy content at or above 10,000 Btu/lb. Removal of fines at the final stages of the cleaning process effectively reduces the content of metal contaminants and metals, such as copper that may be detrimental to the cement manufacturing process. 13
- B. The following section and corresponding table provides documentation that the chemical and physical identity of ASR Fuel is comparable to commercial fuels (40 CFR §241.3)(c)(1)(ii), that material provides heating value for GCC's cement kilns (40 CFR §241.3(d)(ii), and that contaminants in ASR Fuel are comparable to those in traditional fuel (40 CFR §241.3(d)(iii).
 - MEANINGFUL HEAT VALUE: The processed ASR Fuel has a significant fuel value. Calorimetry
 of auto shredder residue samples show that the material has gross heating values in the

¹¹ United States Environmental Protection Agency (EPA), 2011-06-30 "Waste Determination For Oil Filter Fluff That Is Burned In Combustion Units" letter to Trendgreen Associates.

¹² 40 CFR §241.4(a)(5)(i), (ii) and (iii).

¹³ Havlik, Tomas "Recycling of automotive shredder residue by granulometric separation" *MM Science Journal*" June, 2017, pp. 1810-1813.

range of 10,000 to 13,500 Btu/lb on an as-received basis^{14,15}; much greater than 5,000 Btu/lb threshold. The ASR Fuel makes a useful contribution to the cement clinker manufacturing process which inherently requires substantial heat input to drive the process.

2. CONTAMINANT COMPARISON: Table 1 compares contaminants of ASR Fuel with those of the traditional fuel values for fuel that GCC's kilns are designed to utilize¹⁶. GCC's kilns are all designed to utilize solid fuels, and each facility can additionally utilize liquid and/or gaseous fuels. Therefore, the table documents the traditional solid fuel range of values, and additionally lists the liquid and gaseous fuel values for constituents that have concentrations above the high end of the range for solid fuels.

Analytical results from ASR Fuel show that it is a beneficial replacement for traditional fuels in GCC's cement kilns. Sulfur content is typically very low. Chlorine content is such that the material will work efficiently in some, but not all cement manufacturing processes, similar to experiences with solid traditional fuel. Mineral content of ash component has high concentrations of silica, iron and calcium, all of which are beneficial components in the cement manufacturing process. Minerals detrimental to cement manufacturing are negligible. Alkalis are lower than those for many traditional solid fuels.

Four compounds in the volatile organic compound group were detected in auto shredder residue fuel that are not reported in databases for traditional fuel, at very low concentration.

a. Acetone has been detected at levels <1.0 mg/kg in ASR Fuel. Acetone is widely used in industry as a solvent, but is also commonly in everyday application. Acetone is used in the cosmetics industry as finger nail polish remover, in skin creams and makeup; as a gasoline additive to allow fuel to disperse more readily in the intake system; and in the environmental industry to dissolve sludges in oil spills. The U.S. Food and Drug Administration (FDA) has determined acetone is safe for use as an indirect food additive in adhesives and food-contact coatings and is regarded as a Generally Recognized as</p>

¹⁴ Boughton, Robert. 2006. "Evaluation of shredder residue as cement manufacturing feedstock." California Department of Toxic Substances Control.

¹⁵ Cirko, Cathy. 1999. "Auto shredder residue potential fuel for steel mill blast furnaces." Canadian Chemical News, September 1, 1999

¹⁶ Compilation of information from USEPA's Contaminant Concentrations in Traditional Fuels: Tables for Comparison (11/29/2011), and the Materials Characterization Paper (2/7/2011).

Safe (GRAS) substance at certain concentrations. ^{17,18} Acetone is a product of human metabolism, although its role in metabolic processes is not well understood. ¹⁹

- b. *n*-Propylbenzene has been detected at levels <1.0 mg/kg in ASR Fuel. *n*-Propylbenzene is used as an additive in industrial, commercial and consumer paints and coatings.²⁰ It is not expected to pose any risk at the levels reported for ASR Fuel.²¹
- c. 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene have been detected at levels <1.0 mg/kg (combined) in ASR Fuel. Both 1,n,n-trimethylbezene forms are used as additives in industrial, commercial and consumer paints and coatings.²² 1,2,4-trimethylbenzene may also be present in fuel or oil and is isolated during the petroleum refining process.²³ Neither compound is expected to pose any risk at the levels detected in ASR Fuel.²⁴
- C. The storage and materials management for ASR Fuel at all phases from generation to the point of combustion meet the requirements of (40 CFR §241.3)(c)(1)(iii) and (40 CFR §241.3(d)(1)(i)(A)).
 - ASR Fuel is not accumulated in any significant quantity or for any significant period of time
 at the generator facility. Typical storage time is less than one month from the time of
 generation to the time the ASR Fuel is distributed. Distribution occurs by truck or rail, and
 the material is weighed with weights recorded on a uniform bill of lading. Records of ASR
 fuel distribution are recorded and retained. The auto shredder residue is subject to regular
 sampling and laboratory analysis by the generator.
 - 2. ASR Fuel is a solid material in loose bulk form with handling characteristics similar to low-density traditional solid fuels. Storage and management of ASR Fuelat GCC facilities is comparable to storage and management of the traditional solid fuels that the same GCC facilities. ASR Fuelfuel is delivered in trucks with dump trailers or walking floor trailers, or by rail. Incoming material is weighed, and weights are compared to weights on the bill of

¹⁷ 21 CFR §175.105(c)(5) "FOOD FOR HUMAN CONSUMPTION: Substances for Use Only as Components of Adhesives" (accessed 05 December, 2018).

¹⁸ 21 CFR §175.320(b)(3) "FOOD FOR HUMAN CONSUMPTION: Substances for Use as Components of Coatings: Resinous and polymeric coatings for polyolefin films" (accessed OS December, 2018).

¹⁹ Kalapos, M. P. "Possible physiological roles of acetone metabolism in humans" *Medical Hypothyses* Volume 53, Issue 3, September 1998, pp 236-242.

²⁰ National Institutes of Health, U. S. National Library of Medicine, Chemical Information Database #7668 (CID: 7668).

²¹ National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, RTCES# DA8750000.

²² National Institutes of Health, U. S. National Library of Medicine, Chemical Information Database #7668 (CiD: 7947), (CID: 7247).

²³ NIH (CID: 7247) ibid.

²⁴ National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, RTCES# OX6825000 (1,3,5-trimethylbenzene) and RTCES# DA3325000 (1,2,4-trimethylbenzene)

lading. Material is accounted for in accordance with inventory management practices established for other bulk solid fuel and raw material at the combustion facility. Inventory is valued on a first-in-first-out basis. Inventories commonly contain a supply sufficient for 30-90 days of operation, but in no case longer than one year. Inventory time frame is comparable to the time frame in EPA's speculative accumulation concept in RCRA and is consistent with GCC's solid traditional fuels inventory management time frames.

 Any incoming ASR Fuel that does not meet the specification criteria is considered nonconforming material. Loads with identified non-conforming material are rejected prior to acceptance and returned to the generator.

Methods of tracking incoming source material, including documentation procedures, are defined in the QAQC plan for the processor and combustion facility.

Non-conforming material that is identified after incoming ASR Fuel has been accepted by the GCC processor or the GCC combustion facility is evaluated in accordance with South Dakota regulations under the definition of Solid Waste in SDCL: 34A-6-1.3(17) and treated in a manner appropriate to the material type. Non-conforming material is isolated from ASR Fuel and isolated from other consumable materials to prevent inadvertent comingling. The non-conforming material is not stored at the combustion facility and is held only as long as necessary to arrange for proper disposition as outlined below.

Non-conforming, non-waste material is, when possible, used in another part of the process at the combustion facility if the non-waste material meets the definition of, and conforms to the specifications of, a NHSM fuel or ingredient that is already qualified for use at the combustion facility AND is already used at the combustion facility. In this case, "non-conforming material" refers only to material that does not conform to the specifications of ASR Fuel. In cases where the non-conforming, non-waste material will be used at the combustion facility, inventory records will reflect the transfer of that non-conforming material to the correct inventory and the material will be handled in the manner of the material it is supplementing. If the non-conforming non-waste material cannot be used at the combustion facility, it will be transferred or disposed of as appropriate.

Non-conforming, non-hazardous material that is identified as solid waste is transferred to a landfill that accepts the type of waste. Inventory records will reflect the transfer of that non-conforming material to. Non-conforming material that is identified as non-hazardous liquid waste, non-hazardous semisolid waste or non-hazardous contained gaseous waste is picked up by a service company that is qualified to transfer and dispose of non-hazardous waste. Prior to transfer, non-hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

Non-conforming material that is identified as hazardous waste is reported as required for that type of waste. The hazardous waste will be picked up by a hauler qualified to haul the

type of waste identified and delivered to a hazardous waste disposal facility. Prior to transfer, hazardous waste is isolated and/or contained to prevent exposure to workers or release to the environment.

- D. In accordance with 40 CFR §241.3(d)(1)(B) and (C) ASR Fuel is handled in a manner similar to that for traditional solid fuel to prevent releases to air, water or land.
 - 1. TCLP analyses show that VOC, SVOC, PCB, and metal leachates from ASR fuel are well below RCRA limits and well below typical values for traditional solid fuels. Quarterly third-party sampling and testing are conducted and results are reported. Risk of airborne releases is similar to the risk of airborne releases from traditional solid fuel with mixed particle size.
 - 2. At the generator facility, auto shredder residue production, transfer, storage, and loading is conducted in a way that minimizes air-borne and water-borne dispersion. Trucks transporting auto shredder residue are covered to prevent airborne releases. During processing, airborne releases are controlled by enclosed process equipment or with water mist. Rainwater releases are controlled in accordance with a storm water management plan. The generator site is designed as a zero-discharge facility and requires no NPDES permit. Fugitive air emissions are governed by Title V air permit requirements, with controls similar to traditional solid fuels.
 - 3. At the combustion facility, rainwater releases from the ASR Fuel management area at the GCC facilities are controlled by an NPDES storm water permit. Fugitive air emissions are governed by the Title V air permit requirements, and Title V permits are held where required. Air emissions controls comparable to controls used for traditional solid fuels are in place.

Table 1: Fuel Specification & Comparison of Auto Shredder Residue Fuel to Traditional Fuel Tables

Chemical Name	CAS	Units	Auto Shredder Residue Fuel Typical	Coal Range EPA/OAQPS Database	Liquid Traditional Fuel Range (ppm)	Coal Trad. Spec (ppm)	Liquid Trad. Fuel Spec (ppm)	Comparison of Auto Shredder Residue Fuel to Coal and Liquid Fuel
				Metal Elements, ppm - dry basis	npm - dry basis			
Mercury (Hg)	7439-97-6	mg/kg	0.22	ND-3.1		3.1		Lower than coal
Cadmium (Cd)	7440-43-9	mg/kg	2.99	ND-19				Lower than coal
Lead (Pb)	7440-92-1	mg/kg	37.6	ND-148				Lower than coal
Selenium (Se)	7782-49-2	mg/kg	0.1	ND-74.3				Lower than coal
Arsenic (As)	7440-38-2	mg/kg	<0.10	ND-174		174		Lower than coal
Antimony (Sb)	7440-36-0	mg/kg	0.4	ND-10				Lower than coal
Beryllium (Be)	7440-41-7	mg/kg	0.051	ND-206				Lower than coal
Chromium (Cr)	7440-47-3	mg/kg	9.85	ND-168				Lower than coal
Cobalt (Co)	7440-48-4	mg/kg	1.36	ND-30			2 2.2	Lower than coal
Manganese (Mn)	7439-96-5	mg/kg	44.2	ND-512				Lower than coal
Nickel (Ni)	7440-02-0	mg/kg	25.2	ND-730				Lower than coal
				Non-metal Elements, ppm - dry basis	i, ppm - dry basis			
Chlorine (CI)	7782-50-5	mg/kg	1640	ND-9080				Lower than coal
Fluorine (F)	7782-41-4	mg/kg	19.3	ND-178				Lower than coal
Nitrogen	7727-37-9	mg/kg	16,300	13,600-54,000	ND-150,000	67,500		Lower than coal
Sulfur (S)	7704-34-9	mg/kg	0	740-61,300	ND-150,000	76,625	187,500	Lower than coal
			Volatile	e Organic Compound	le Organic Compounds (VOC), ppm - dry basis	is		
Benzene	71-43-2	mg/kg	0.036	ND-38.6	ND-75	38.6	75	Lower than coal
Ethylbenzene	100-41-4	mg/kg	0.017	0.7-5.4	22-1,270			Lower than coal
Styrene	100-42-5	mg/kg	0.220	1.0-26	ND-320			Lower than coal
Toluene	108-88-3	mg/kg	0.260	8.6-56	ND-380			Lower than coal
Cumene	98-82-8	mg/kg	ND		6,000-8,600			QN
Formaldehyde	20-00-0	mg/kg	ND	1.6-2.7				QN
Hexane	110-54-3	mg/kg	ND		50-10,000			QN
Phenol	108-95-2	mg/kg	ND		ND-7,700			ND
Xylenes	1330-20-7	mg/kg	0.710	4.0-28	ND-3,100			Lower than coal
Naphthalene	91-20-3	mg/kg	990.0		ND-7,330			Lower than liquid fuel
Biphenyl	92-52-4	mg/kg	ND		1,000-1,200			QN
Polycyclic hydrocarhons		ma//ca	9900	14-2090	3 900-54 700		Ì	loss northwared